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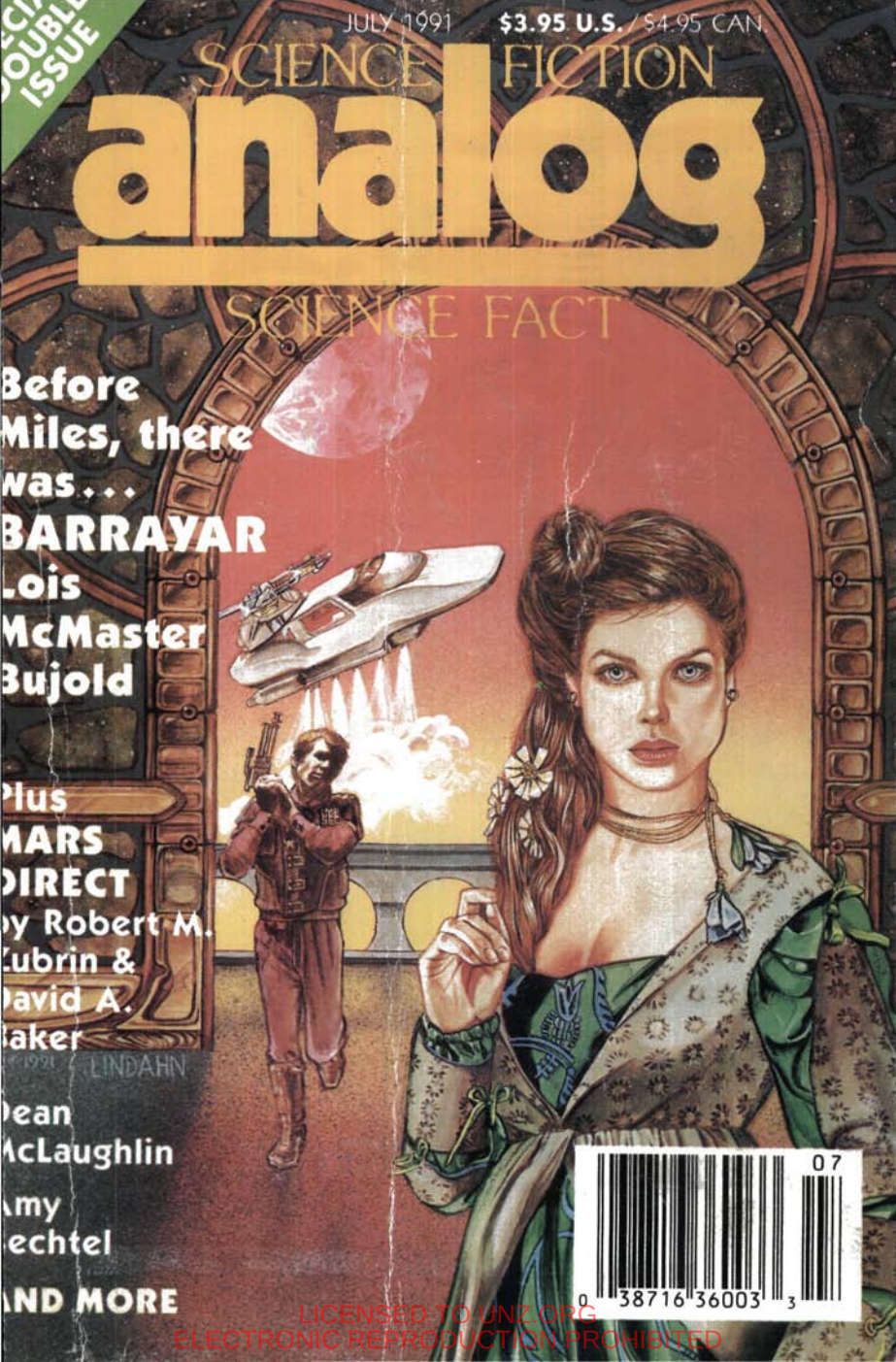

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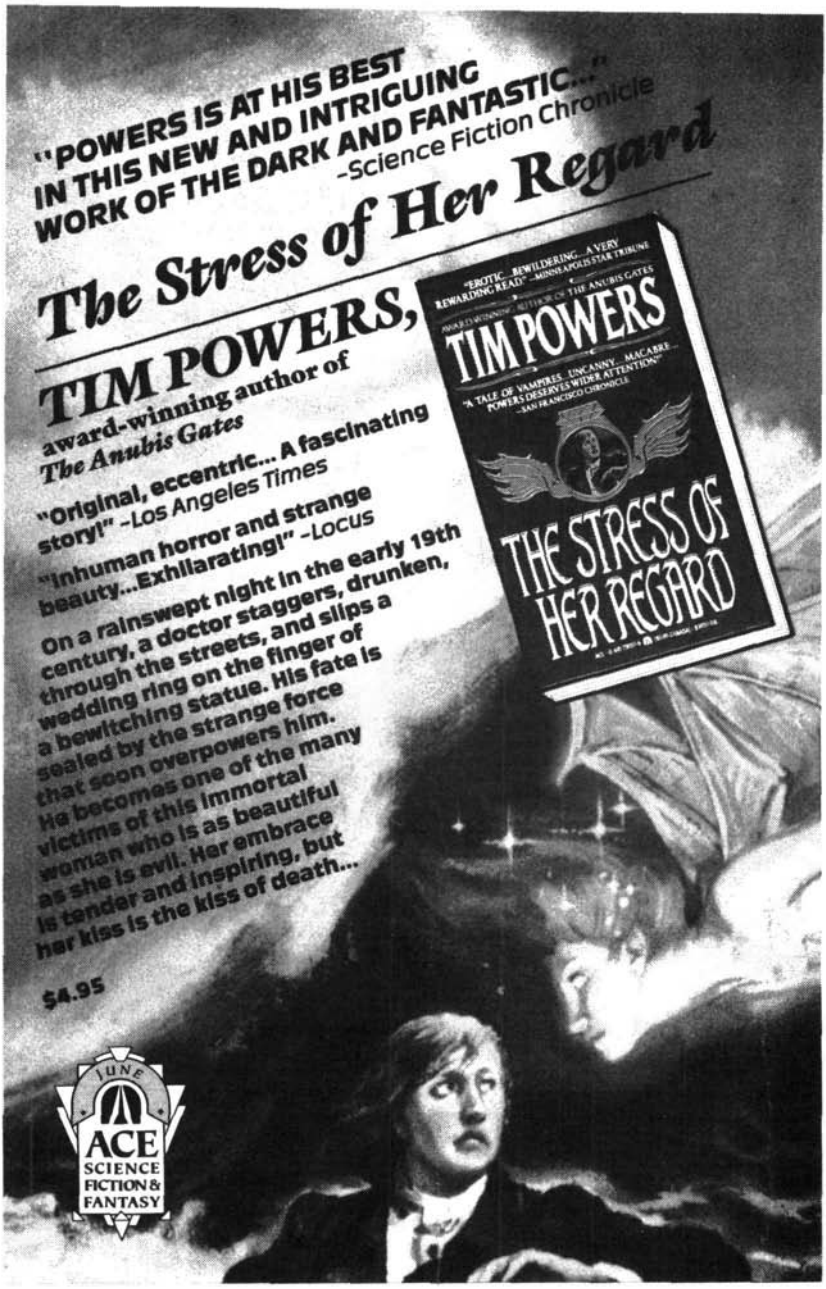
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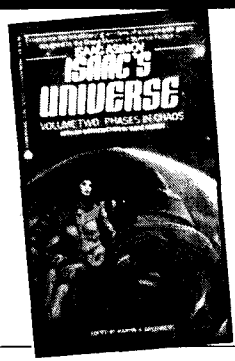

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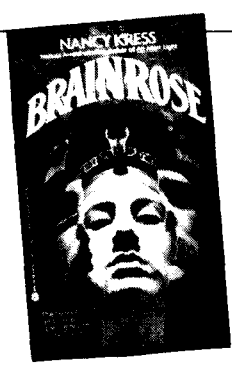

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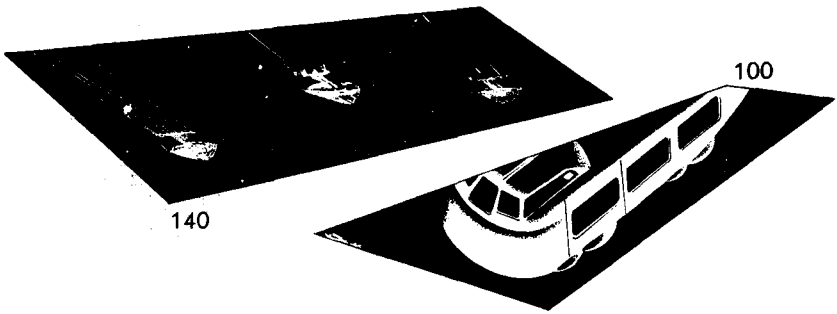

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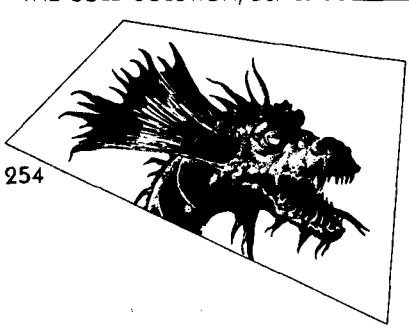

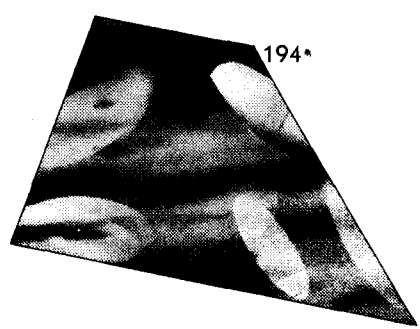

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Editorial

THE CAMERA AS WEAPON

Stanley Schmidt

This is one of those times when I wish it took less than six months to get these words into print. I don't know what the international situation will look like when you read this, in early summer; and what I would really like to say might be considerably different depending on which way things went. That can't be helped; now is the time to look at what I want to look at, and the long time lag in publication is something I'll just have to work around.

I propose to do that by reminding you of how things looked at the time I wrote this, in mid-December 1990. They didn't look the same to everybody, of course, and I'll try to take that into account. The salient fact is that one Middle Eastern country, under what we might call single-handed leadership, a few months earlier invaded and forcibly took over another. The rest of the international community reacted with outrage that was surprisingly close to unanimous, demanding the conquering country's withdrawal from the conquered, applying economic sanctions, and approving the use of military force if withdrawal didn't happen by mid-January.

A leader in the demand for withdrawal, and in particular in advocating the use of military force, was the president of the United States, who issued a series of emphatic statements and ordered a massive buildup of US military forces in the Mideast. Initially these forces were said to be there to protect another neighboring country, but it wasn't long before it was made clear

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that they were intended to have a strong offensive capability as well.

Initially also, the president's strong words and swift actions enjoyed a great deal of popular support among American citizens. That began slipping away as the months went by, and by mid-December much more dissent was heard in the land. Sizable numbers still favored the course the president had set, but more and more others began to question whether the war that seemed to be brewing was one America should fight. Even some military people and their families openly questioned what they were doing over there, and whether it warranted the sacrifice of American lives. A wide spectrum of citizens cynically wondered whether this was really a war "against naked aggression" (would the president have done the same if Guatemala invaded Belize?) so much as a war to protect cheap oil. Some suggested that the effort going into intervening in what looked to them like a purely foreign affair might be better spent on an intensive program to make us less dependent on foreign oil. Many—including quite a few in Congress—feared that the president appeared far too *eager* for war, and that he appeared to be taking action on his own that constitutionally required the participation of Congress.

So Congress began, in its characteristically molasseslike way, to participate, debating what *should* be done. Meanwhile the Mideastern conqueror finally released the thousands of foreign hostages he'd been holding, but showed no overt signs of giving in to the demands for withdrawal from his neighbor. Both sides have agreed in principle to meet for talks, though both expressly deny any willingness to budge from their present stands (a peculiar but historically unsurprising basis for discussion). That's where things stand as I write this: Mideastern conqueror still firmly entrenched, international economic sanctions in place, and the US divided into factions favoring or opposing going to war to throw him out.

What does all this have to do with *Analog*'s concerns? Well, our principal concern is the future, and in particular the way new knowledge and technologies shape it. The above is necessary background for what I really want to talk about: a speculation about how the future might be changing as a result of the growing use of a rather old invention.

In a syndicated column in early December, George Will speculated on the way photographic coverage of wars has begun to change people's attitudes toward them. For a long time, most people who were not actually frontline participants saw wars only as numbers and hearsay: things like letters and news stories. Initially these were just words. Later words were augmented by pictures, though editors discreetly made sure their readers were spared the sight of actual battlefield gore. Photographers such as Mathew Brady, during the Civil War, *took* such pictures, but they did not see print in their own time.

All this ensured that war, for most citizens, was something to think about in the abstract. It was easy to advocate

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and easy to glorify when few people actually saw the ugly reality of it. This was especially true, and significant, for those in positions of political power. It has often been pointed out that wars are typically declared by old men who won't have to fight them, and fought by young ones who must do the dirty work, and sometimes die, for reasons that they understand only distantly (if at all).

By the time of the Vietnam War, things had changed to the point where television coverage of the front, sometimes including fairly graphic footage, was a daily event. Some feared that such constant exposure might desensitize people—that it might make killing seem too routine to occasion much moral concern. But George Will suggests a quite different effect, from a rather unlikely-seeming source. In 1990, PBS showed a television series on the Civil War that *did* include some of Matt Brady's more graphic pictures of death and dismemberment. Many who saw them were deeply affected. And in early December

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George Will wrote, "It cannot be proven but it is believable that today's public wariness about war in the gulf is, at least in small part, a result of recent exposure to black-and-white photographs 125 years old."

Will apparently sees this as something to worry about. "In Indochina in the 1960s," he writes, "cameras would change the relationship between war and the home front, and hence would limit the ability of democracies to have recourse to force." And later, "Because of television, which makes war's horrors instantaneously and universally immediate, democratic leaders must take extraordinary care to prepare civilians for the facts of combat"—a suggestion which, to some, might sound uncomfortably like, "Lay on the propaganda!"

I can understand, if not entirely agree with, Will's concern, at least in the short term. If the citizens of democracies, allowed at last to see what war really looks like, develop such a revulsion to it that they cannot bring themselves to participate, might they then be completely at the mercy of global bullies who have no such scruples? A surgeon who faints at the sight of blood cannot do what needs to be done. Will, as I read his column, fears that democracies might be put in a similar situation if they are allowed to see these things while people in other countries, with less access to information and less control of their own governments, are not. He feared specifically that a known squeamishness of Americans about the violence of war might be used as a psychological weapon by the other side in the conflict brewing as he and I wrote.

Certainly the problem bears thinking about. As long as global bullies exist, others must have ways of dealing with them. But might there not be, at least in the long run, another side to the "Will effect"? Suppose populations *everywhere* could be exposed to things like Matt Brady's scariest photos, and thereby made to see, with no delicate censorship by either editors or states, what war would really mean? If Will's conjecture is right, might not populations all over the world then become more wary of war as an easy solution, and more insistent that their leaders try *very* hard to find other ways of solving problems? Might some of them even go so far as to demand that leaders who want to take their countries into war show their sincerity by going themselves, turning their civilian responsibilities over to others as they go the front lines to share the combat they thought worthwhile for others? And if things like this became widespread, is it not just conceivable that such a worldwide change in mindset might do more than anything that has ever happened to make war an obsolete concept?

Nothing like this, of course, is going to happen immediately and spontaneously. In many countries, citizens are not allowed by their own governments to see such things. Nor are they allowed to have much voice in what those governments do. But revolutions have occurred—some rather important ones quite recently—and no doubt there will be others in the future. A citizenry suf-

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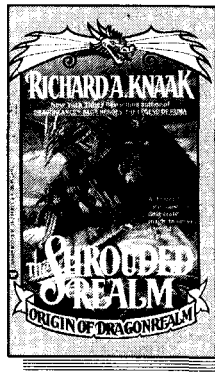

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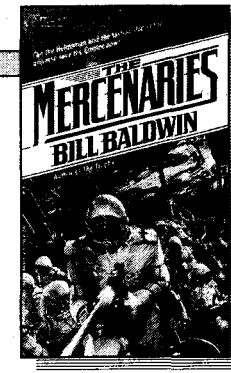

A WORD FROM BRIAN THOMSEN

Sometimes you have to go back to the beginning in order to go forward. With THE SHROUDED REALM we travel back to a time prior to the previous four *Dragonrealm* books to tell the story of how it all began. This is not that different from what Wilf Brimm has to do in THE MERCENARIES, where he must put together a new fighting force almost from scratch. In both books it is a new beginning.

It's sometimes good to begin again, relive old memories, visit familiar haunts, etc. That's why I like series books—they are like old friends who come back to visit.

When you see me around ask me about next month's visit to a past which has never existed.

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ficiently informed and aroused can *insist* on getting control of its own government. And information can be delivered to people by means other than the channels officially approved by their present governments. . . .

One can imagine the camera, the printing press, and the television transmitter becoming weapons in a new kind of "war to end war." Let *everybody* know, in no uncertain terms, what war is like, and what it will mean in personal terms if they get into one! Who knows where that might lead?

An interesting possibility to contemplate, at any rate, in a season when half the news is devoted to talk about "peace on Earth, good will toward men," and the other half to the war that might break out next month. ■

IN TIMES TO COME

● Back in 1967, this magazine published the novella "Weyr Search," thus launching Anne McCaffrey's enormously popular series about the planet Pern. The fact that Pern's best-known inhabitants are its dragons has sometimes led careless readers to mistake stories like *Dragonflight* for fantasy, and to express surprise that they first appeared in *Analog*. In fact, of course, *Dragonflight* is one of the best examples I know of a story in which the author thought her background out quite carefully, but none of the characters is in a position to explain it!

As the lead story in our August issue, we're delighted to present a hefty new novella about Pern, called "Rescue Run." This one contains no dragons at all—but it does answer some questions Anne McCaffrey has been getting from her readers for quite some time!

We'll also feature a fact article by Stephen L. Gillett, Ph.D., for those who are concerned about their Earthly environment and take a *really* long view: what do you do when the internal energy sources that drive the planet itself get exhausted?

And, of course, we'll have Part II of Lois McMaster Bujold's "pre-Miles" saga, *Barrayar*.

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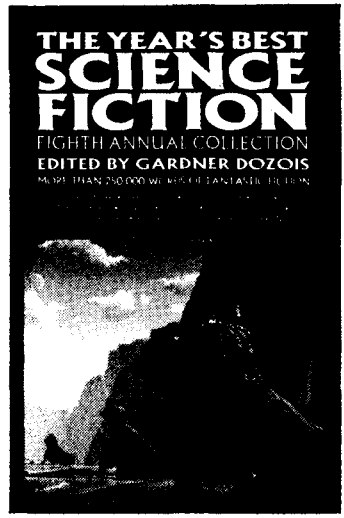

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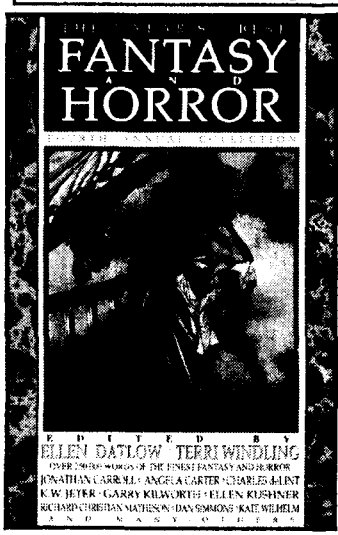
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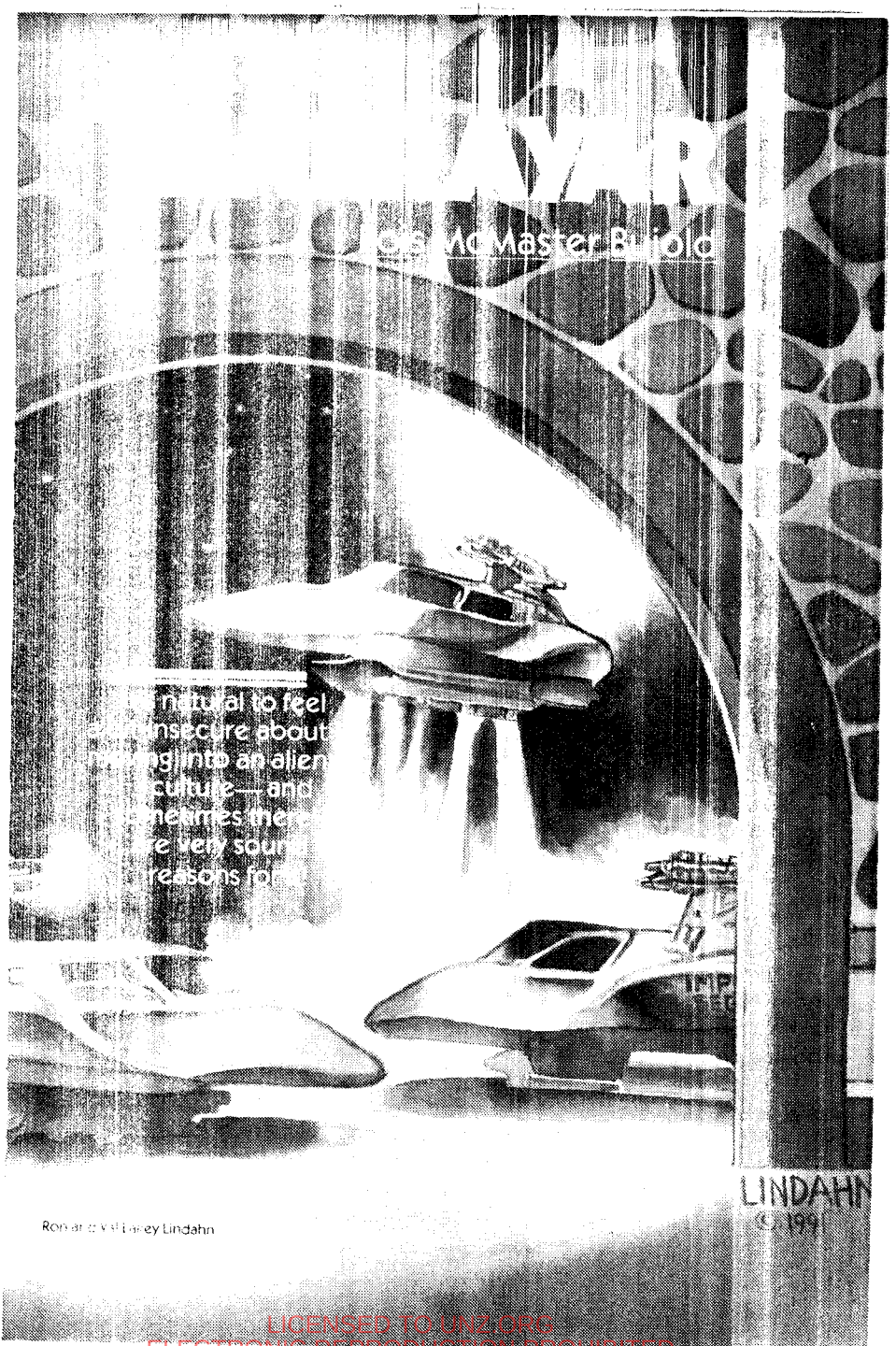

Ron and Val Lindahn

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PART I

CHAPTER ONE

I am afraid. Cordelia's hand pushed aside the drape in the third floor parlor window of Vorkosigan House. She stared down into the sunlit street below. A long silver groundcar was pulling into the half-circular drive that serviced the front portico, braking past the spiked iron fence and the Earth-imported shrubbery. A government car. The door of the rear passenger compartment swung up, and a man in a green uniform emerged. Despite her foreshortened view Cordelia recognized Commander Illyan, brown-haired and hatless as usual. He strode out of sight under the portico. *Guess I don't really need to worry till Imperial Security comes for us in the middle of the night.* But a residue of dread remained, burrowed in her belly. *Why did I ever come here to Barrayar? What have I done to myself, to my life?*

Booted footsteps sounded in the corridor, and the door of the parlor creaked inward. Sergeant Bothari stuck his head in, and grunted with satisfaction at finding her. "Milady. Time to go."

"Thank you, Sergeant." She let the drape fall, and turned to inspect herself one last time in a wall-mounted mirror above the archaic fireplace. Hard to believe people here still burned vegetable matter just for the release of its chemically-bound heat.

She lifted her chin, above the stiff white lace collar of her blouse, adjusted the sleeves of her tan jacket, and kicked her knee absently against the long swirling skirt of a Vor-class woman, tan to match the jacket. The color comforted her, almost the same tan as her old Betan Astronomical Survey fatigues. She ran her hands over her red hair, parted in the middle and held away from her face by two enameled combs, and flopped it over her shoulders to curl loosely halfway down her back. Her grey eyes stared back at her from the pale face in the mirror. Nose a little too boney, chin a shade too long, but certainly a serviceable face, good for all practical purposes.

Well, if she wanted to look dainty, all she had to do was stand next to Sergeant Bothari. He loomed mournfully beside her, all two meters of him. Cordelia considered herself a tall woman, but the top of her head was only level with his shoulder. He had a gargoyle's face, closed, wary, beak-nosed, its lumpiness exaggerated to criminality by his military-burr haircut. Even Count Vorkosigan's elegant livery, dark brown with the symbols of the house embroidered in silver, failed to save Bothari from his astonishing ugliness. *But a very good face indeed, for practical purposes.*

A liveried retainer. What a concept. What did he retain? *Our lives, our fortunes, and our sacred honors, for starters.* She nodded cordially to him, in the mirror, and about-faced to follow him through the warren of Vorkosigan House.

She must learn her way around this great pile of a residence as soon as possible. Embarrassing, to be lost in one's own home, and have to ask some passing guard or servant to de-tangle one. In the middle of the night, wearing only a towel. *I used to be a jumpship navigator. Really.* If she could handle five dimensions upside, surely she ought to

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be able to manage a mere three downside.

They came to the head of a large circular staircase, curving gracefully down three flights to a black-and-white stone-paved foyer. Her light steps followed Bothari's measured tread. Her skirts made her feel as if she was floating, parachuting inexorably down the spiral.

A tall young man, leaning on a cane at the foot of the stairs, looked up at the echo of their feet. Lieutenant Koudelka's face was as regular and pleasant as Bothari's was narrow and strange, and he smiled openly at Cordelia. Even the pain lines at the corners of his eyes and mouth failed to age that face. He wore Imperial undress greens, identical but for the insignia to Security Commander Illyan's. The long sleeves and high neck of his jacket concealed the tracery of thin red scars that netted half his body, but Cordelia mapped them in her mind's eye. Nude, Koudelka could pose as a visual aid for a lecture on the structure of the human nervous system, each scar representing a dead nerve excised and replaced with artificial silver threads. Lieutenant Koudelka was not quite used to his new nervous system yet. *Speak truth. The surgeons here are ignorant clumsy butchers.* The work was certainly not up to Betan standards. Cordelia permitted no hint of this private judgment to escape onto her face.

Koudelka turned jerkily, and nodded to Bothari. "Hello, Sergeant. Good morning, Lady Vorkosigan."

Her new name still seemed strange to her ear, ill-fitting. She smiled back. "Good morning, Kou. Where's Aral?"

"He and Commander Illyan went into the library, to check out where the new secured comconsole will be installed. They should be right along. Ah." He nodded, as footsteps sounded through an archway. Cordelia followed his gaze. Illyan, slight and bland and polite, flanked—was eclipsed by—a man in his mid-forties resplendent in Imperial dress greens. The reason she'd come to Barrayar.

Admiral Lord Aral Vorkosigan, retired. Formerly retired, till yesterday. Their lives had surely been turned upside down, yesterday. *We'll land on our feet somehow, you bet.* Vorkosigan's body was stocky and powerful, his dark hair salted with grey. His heavy jaw was marred by an old L-shaped scar. He moved with compressed energy, his grey eyes intense and inward, until they lighted on Cordelia.

"I give you good morrow, my lady," he sang out to her, reaching for her hand. The syntax was self-conscious but the sentiment naked-sincere in his mirror-bright eyes. *In those mirrors, I am altogether beautiful,* Cordelia realized warmly. *Much more flattering than that one on the wall upstairs. I shall use them to see myself from now on.* His thick hand was dry and hot, welcome heat, live heat, closing around her cool tapering fingers. *My husband.* That fit, as smoothly and tightly as her hand fit in his, even though her new name, *Lady Vorkosigan,* still seemed to slither off her shoulders.

She watched Bothari, Koudelka, and Vorkosigan standing together for that brief moment. *The walking wounded, one, two, three. And me, the lady auxiliary.* The survivors. Kou in body, Bothari in mind, Vorkosigan in spirit, all had taken near-mortal wounds in the

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late war at Escobar. *Life goes on. March or die. Do we all begin to recover at last?* She hoped so.

"Ready to go, dear Captain?" Vorkosigan asked her. His voice was a baritone, his Barrayaran accent gutteral-warm.

"Ready as I'll ever be, I guess."

Illyan and Lieutenant Koudelka led the way out. Koudelka's walk was a loose-kneed shamble beside Illyan's brisk march, and Cordelia frowned doubtfully. She took Vorkosigan's arm, and they followed, leaving Bothari to his household duties.

"What's the timetable for the next few days?" she asked.

"Well, this audience first, of course," Vorkosigan replied. "After which I see the men. Count Vortala will be choreographing that. In a few days comes the vote of consent from the full Councils Assembled, and my swearing-in. We haven't had a Regent in 120 years. God knows what protocol they'll dig out and dust off."

Koudelka sat in the front compartment of his groundcar with the uniformed driver. Commander Illyan slid in opposite Cordelia and Vorkosigan, facing rearward, in the back compartment. *This car is armored,* Cordelia realized from the thickness of the transparent canopy as it closed over them. At a signal from Illyan to the driver, they pulled away smoothly into the street. Almost no sound penetrated from the outside.

"Regent-consort," Cordelia tasted the phrase. "Is that my official title?"

"Yes, milady," said Illyan.

"Does it have any official duties to go with it?"

Illyan looked to Vorkosigan, who said, "Hm. Yes and no. There will be a lot of ceremonies to attend—grace, in your case. Beginning with the emperor's funeral, which will be grueling for all concerned—except, perhaps, for Emperor Ezar. All that waits on his last breath. I don't know if he has a timetable for that, but I wouldn't put it past him.

"The social side of your duties can be as much as you wish. Speeches and ceremonies, important weddings and name-days and funerals, greeting deputations from the Districts—public relations, in short. The sort of thing Princess-dowager Kareen does with such flair." Vorkosigan paused, taking in her appalled look, and added hastily, "Or, if you choose, you can live a completely private life. You have the perfect excuse to do so right now—" his hand, around her waist, secretly caressed her still-flat belly, "and in fact I'd rather you didn't spend yourself too freely.

"More importantly, on the political side . . . I'd like it very much if you could be my liaison with the Princess-dowager, and the . . . child emperor. Make friends with her, if you can; she's an extremely reserved woman. The boy's upbringing is vital. We must not repeat Ezar Vorbarra's mistakes."

"I can give it a try," she sighed. "I can see it's going to be quite a job, passing for a Barrayaran Vor."

"Don't bend yourself painfully. I shouldn't like to see you so constricted. Besides, there's another angle."

"Why doesn't that surprise me? Go ahead."

He paused, choosing his words. "When the late Crown Prince Serg

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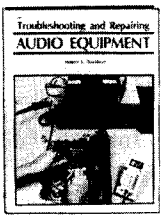

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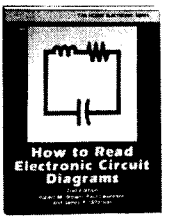

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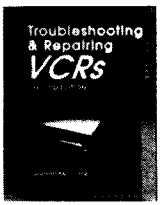

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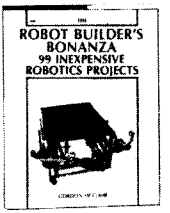

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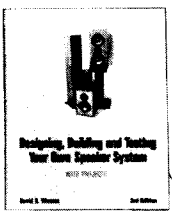

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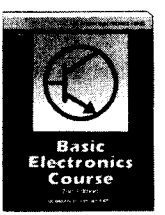

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called Count Vortala a phoney progressive, it wasn't altogether nonsense. Insults that sting always have some truth in them. Count Vortala has been trying to form his progressive party in the upper classes only. Among the people who matter, as he would say. You see the little discontinuity in his thinking?"

"About the size of Hogarth Canyon back home? Yes."

"You are a Betan, a woman of galactic-wide reputation."

"Oh, come on now."

"You are seen so here. I don't think you quite realize how you are perceived. Very flattering for me, as it happens."

"I hoped I was invisible. But I shouldn't think I'd be too popular, after what we did to your side at Escobar."

"It's our culture. My people will forgive a brave soldier almost anything. And you, in your person, unite two of the opposing factions—the aristocratic military, and the pro-galactic plebians. I really think I could pull the whole middle out of the People's Defense League through you, if you're willing to play my cards for me."

"Good heavens. How long have you been thinking about this?"

"The problem, long. You as part of the solution, just today."

"What, casting me as figurehead for some sort of constitutional party?"

"No, no. That is just the sort of thing I will be sworn, on my honor, to prevent. It would not fulfill the spirit of my oath to hand over to Prince Gregor an emperorship gutted of power. What I want . . . what I want is to find some way of pulling the best men, from every class and language group and party, into the emperor's service. The Vor have simply too small a pool of talent. Make the government more like the military at its best, with ability promoted regardless of background. Emperor Ezar tried to do something like that, by strengthening the Ministries at the expense of the Counts, but it swung too far. The Counts are eviscerated and the Ministries are corrupt. There must be some way to strike a balance."

Cordelia sighed. "I guess we'll just have to agree to disagree, about constitutions. Nobody appointed me Regent of Barrayar. I warn you, though—I'll keep trying to change your mind."

Illyan raised his brow at this. Cordelia sat back wanly, and watched the Barrayaran capital city of Vorbarr Sultana pass by through the thick canopy. She hadn't married the Regent of Barrayar, four months back. She'd married a simple retired soldier. Yes, men were supposed to change after marriage, usually for the worse, but—this much? this fast? *This isn't the duty I signed up for, sir.*

"That's quite a gesture of trust Emperor Ezar placed in you yesterday, appointing you Regent. I don't think he's such a ruthless pragmatist as you'd have me believe," she remarked.

"Well, it is a gesture of trust, but driven by necessity. You didn't catch the significance of Captain Negri's assignment to the princess' household, then."

"No. Was there one?"

"Oh, yes, a very clear message. Negri is to continue right on in his old job as chief of Imperial Security. He will not, of course, be making his reports to a four-year-old boy, but to me. Commander Illyan will in fact merely be his assistant." Vorkosigan and Illyan ex-

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changed mildly ironic nods. "But there is no question where Negri's loyalties will lie, in case I should, um, run mad and make a bid for Imperial power in name as well as fact. He unquestionably has secret orders to dispose of me, in that event."

"Oh. Well, I guarantee I have no desire whatsoever to be empress of Barrayar. Just in case you were wondering."

"I didn't think so."

The groundcar paused at a gate in a stone wall. Four guards inspected them thoroughly, checked Illyan's passes, and waved them through. All those guards, here, at Vorkosigan House —what did they guard against? Other Barrayarans, presumably, in the faction-fractured political landscape. A very Barrayaran phrase the old Count had used that tickled her humor now ran, disquieting, through her memory. *With all this manure around, there's got to be a pony someplace.* Horses were practically unknown on Beta Colony, except for a few specimens in zoos. *With all these guards around . . . but if I'm not anyone's enemy, how can anyone be my enemy?*

Illyan, who had been shifting in his seat, now spoke up. "I would suggest, sir," he said tentatively to Vorkosigan, "even beg, that you reconsider and take up quarters here at the Imperial Residence. Security problems—my problems—" he smiled slightly, bad for his image, with his snub features it made him look puppyish, "will be very much easier to control here."

"What suite did you have in mind?" asked Vorkosigan.

"Well, when . . . Gregor succeeds, he and his mother will be moving into the emperor's suite. Kareen's rooms will then be vacant."

"Prince Serg's you mean." Vorkosigan looked grim. "I . . . think I would prefer to take official residence at Vorkosigan House. My father spends more and more time in the country at Vorkosigan Surleau these days, I don't think he'll mind being shifted."

"I can't really endorse that idea, sir. Strictly from a security standpoint. It's in the old part of town. The streets are warrens. There are at least three sets of old tunnels under the area, from old sewage and transport systems, and there are too many new tall buildings overlooking that have, er, commanding views. It will take at least six full-time patrols for the most cursory protection."

"Do you have the men?"

"Well, yes."

"Vorkosigan House, then." Vorkosigan consoled Illyan's disappointed look. "It may be bad security, but it's very good public relations. It will give an excellent air of, ah, soldierly humility to the new Regency. Should help reduce palace coup paranoia."

And here they were at the very palace in question. As an architectural pile, the Imperial Residence made Vorkosigan House look small. Sprawling wings rose two to four stories high, accented with sporadic towers. Additions of different ages criss-crossed each other to create both vast and intimate courts, some justly proportioned, some rather accidental-looking. The east facade was of the most uniform style, heavy with stone carving. The north side was more cut-up, interlocking with elaborate formal

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gardens. The west was the oldest, the south the newest construction.

The groundcar pulled up to a two-story porch on the south side, and Illyan led them past more guards and up wide stone stairs to an extensive second-floor suite. They climbed slowly, matching steps to Lieutenant Koudelka's awkward pace. Koudelka glanced up with a self-conscious apologetic frown, then bent his head again in concentration—or shame? *Doesn't this place have a lift tube?* Cordelia wondered irritably. On the other side of this stone labyrinth, in a room with a northern view of the gardens, a white old man lay drained and dying on his enormous ancestral bed. . . .

In the spacious upper corridor, softly carpeted and decorated with paintings and side tables cluttered with knick-knacks—objets d'art, Cordelia supposed—they found Captain Negri talking in low tones with a woman who stood with her arms folded. Cordelia had met the famous—or infamous—Chief of Barrayaran Imperial Security for the first time yesterday, after Vorkosigan's historic job interview in the northern wing with the soon-to-be-late Ezar Vorbarra. Negri was a hard-faced, hard-bodied, bullet-headed man who had served his emperor, body and blood, for the better part of forty years, a sinister legend with unreadable eyes.

Now he had bowed over her hand and called her "milady" as if he meant it, or at least no more tinged with irony than any of his other statements. The alert blonde woman—girl?—wore an ordinary civilian dress. She was tall and heavily muscled, and she looked back at Cordelia with even greater interest.

Vorkosigan and Negri exchanged curt greetings in the telegraphic style of two men who had been communicating for so long all of the amenities had been compressed into some kind of tight-burst code. "And this is Miss Droushnakovi," Negri did not so much introduce as label the woman for Cordelia's benefit, with a wave of his hand.

"And what's a Droushnakovi?" asked Cordelia lightly and somewhat desperately. Everybody always seemed to get briefed around here but her, though Negri had also failed to introduce Lieutenant Koudelka; Koudelka and Droushnakovi glanced covertly at each other.

"I'm a Servant of the Inner Chamber, milady." Droushnakovi gave her a ducking nod, half a curtsey.

"And what do you serve? Besides the chamber."

"Princess Kareen, milady. That's just my official title. I'm listed on Captain Negri's staff budget as Bodyguard, Class One." It was hard to tell which title gave her more pride and pleasure, but Cordelia suspected it was the latter.

"I'm sure you must be good, to be so ranked by him."

This won a smile, and a "Thank you, milady. I try."

They all followed Negri through a nearby door to a long, sunny yellow room with lots of south-facing windows. Cordelia wondered if the eclectic mix of furnishings were priceless antiques, or merely shabby seconds. She couldn't tell. A woman waited on a yellow silk settee at the far end, watching them gravely as they trooped toward her en masse.

Princess-dowager Kareen was a thin, strained-looking woman of thirty with

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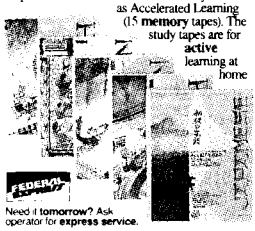

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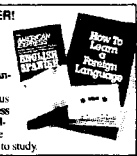

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elaborately-dressed, beautiful dark hair, though her grey gown was of a simple cut. Simple but perfect. A dark-haired boy of four or so was sprawled on the floor on his stomach muttering to his cat-sized toy stegosaurus, which muttered back. She made him get up and turn off the robot toy, and sit beside her, though his hands still clutched the leathery stuffed beast in his lap. Cordelia was relieved to see the boy prince was sensibly dressed for his age in comfortable-looking play clothes.

In formal phrases, Negri introduced Cordelia to the princess and Prince Gregor. Cordelia wasn't sure whether to bow, curtsey, or salute, and ended up ducking her head rather like Droushnakovi. Gregor, solemn, stared at her most doubtfully, and she tried to smile back in what she hoped was a reassuring way.

Vorkosigan went down on one knee in front of the boy—only Cordelia saw Aral swallow—and said, "Do you know who I am, Prince Gregor?"

Gregor shrank a little against his mother's side, and glanced up at her. She nodded encouragement. "Lord Aral Vorkosigan," Gregor said in a thin voice.

Vorkosigan gentled his tone, relaxed his hands, self-consciously trying to dampen his usual intensity. "Your grandfather has asked me to be your Regent. Has anybody explained to you what that means?"

Gregor shook his head mutely; Vorkosigan quirked a brow at Negri, a whiff of censure. Negri did not change expression.

"That means I will do your grandfather's job until you are old enough to do it yourself, when you turn twenty. The next sixteen years. I will look after you and your mother in your grandfather's place, and see that you get the education and training to do a good job, like your grandfather did. Good government."

Did the kid even know yet what a government was? Vorkosigan had been careful not to say, *in your father's place*, Cordelia noted dryly. Careful not to mention Crown Prince Serg at all. Serg was well on his way to being disappeared from Barrayaran history, it seemed, as thoroughly as he had been vaporized in orbital battle.

"For now," Vorkosigan continued, "your job is to study hard with your tutors and do what your mother tells you. Can you do that?"

Gregor swallowed, nodded.

"I think you can do well." Vorkosigan gave him a firm nod, identical to the ones he gave his staff officers, and rose.

I think you can do well too, Aral, Cordelia thought.

"While you are here, sir," Negri began, after a short wait to be certain he wasn't stepping on some further word, "I wish you would come down to Ops. There are two or three reports I'd like to present. The latest from Darkoi seems to indicate that Count Vorlakail was dead before his Residence was burned, which throws a new light —or shadow —on that matter. And then there is the problem of revamping the Ministry of Political Education—"

"Dismantling, surely," Vorkosigan muttered.

"As may be. And, as ever, the latest sabotage from Komarr—"

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"I get the picture. Let's go. Cordelia, ah . . ."

"Perhaps Lady Vorkosigan would care to stay and visit a while," Princess Kareen murmured on cue, with only a faint trace of irony.

Vorkosigan shot her a look of gratitude. "Thank you, milady."

She absently stroked her fine lips with one finger, as all the men trooped out, relaxing slightly as they exited. "Good. I'd hoped to have you all to myself." Her expression grew more animated, as she regarded Cordelia. At a wordless touch, the boy slid off the bench and returned, with backward glances, to his play.

Droushnakovi frowned down the room. "What was the matter with that lieutenant?" she asked Cordelia.

"Lieutenant Koudelka was hit by nerve disruptor fire," Cordelia said stiffly, uncertain if the girl's odd tone concealed some kind of disapproval. "A year ago, when he was serving Aral aboard the *General Vorkraft*. The neural repairs do not seem to be quite up to galactic standard." She shut her mouth, afraid of seeming to criticize her hostess. Not that Princess Kareen was responsible for Barrayar's dubious standards of medical practice.

"Oh. Not during the Escobar war?" said Droushnakovi.

"Actually, in a weird sense, it was the opening shot of the Escobar war. Though I suppose you would call it friendly fire." Mind-boggling oxymoron, that phrase.

"Lady Vorkosigan—or should I say, Captain Naismith—was there," remarked Princess Kareen. "She should know."

Cordelia found her expression hard to read. How many of Negri's famous reports was the princess privy to?

"How terrible for him! He looks as though he had been very athletic," said the bodyguard.

"He was." Cordelia smiled more favorably at the girl, relaxing her defensive hackles. "Nerve disruptors are filthy weapons, in my opinion." She scrubbed absently at the sense-dead spot on her thigh, disruptor-burned by no more than the nimbus of a blast that had fortunately not penetrated subcutaneous fat to damage muscle function. Clearly, she should have had it fixed before she'd left home.

"Sit, Lady Vorkosigan," Princess Kareen patted the settee beside her, just vacated by the emperor-to-be. "Drou, will you please take Gregor to his lunch?"

Droushnakovi nodded understandingly, as if she had received some coded under layer to this simple request, gathered up the boy, and walked out hand-in-hand with him. His child-voice drifted back. "Droushie, can I have a cream cake? And one for Steggie?"

Cordelia sat gingerly, thinking about Negri's reports, and Barrayaran disinformation about their recent aborted campaign to invade the planet Escobar. Escobar, Beta Colony's good neighbor and ally . . . the weapons that had disintegrated Crown Prince Serg and his ship high above Escobar had been bravely convoyed through the Barrayaran blockade by one Captain Cordelia Naismith, Betan Expeditionary Force. That much truth was plain and public and not to be apologized for. It was the secret history, behind the scenes in the

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Barrayaran high command, that was so . . . treacherous, Cordelia decided, was the precise word. Dangerous, like ill-stored toxic waste.

To Cordelia's astonishment, Princess Kareen leaned over, took her right hand, lifted it to her lips, and kissed it hard.

"I swore," said Kareen thickly, "that I would kiss the hand that slew Ges Vorrutyer. Thank you. Thank you." Her voice was breathy, earnest, tear-caught, grateful emotion naked in her face. She sat up, her face growing reserved again, and nodded. "Thank you. Bless you."

"Uh . . ." Cordelia rubbed at the kissed spot. "Um . . . I . . . this honor belongs to another, milady. I was present, when Admiral Vorrutyer's throat was cut, but it was not by my hand."

Kareen's hands clenched in her lap, and her eyes glowed. "Then it *was* Lord Vorkosigan!"

"No!" Cordelia's lips compressed in exasperation. "Negri should have given you the true report. It was Sergeant Bothari. Saved my life, at the time."

"Bothari?" Kareen sat bolt upright in astonishment. "Bothari the monster, Bothari, Vorrutyer's mad batman?"

"I don't mind getting blamed in his place, ma'am, because if it had become public they'd have been forced to execute him for murder and mutiny, and this gets him off and out. But I . . . but I should not steal his praise. I'll pass it on to him if you wish, but I'm not sure he remembers the incident. He went through some draconian mind-therapy after the war, before they discharged him—what you Barrayarans call therapy—" on a par with their neurosurgery, Cordelia feared, "and I gather he wasn't exactly, uh, normal before that, either."

"No," said Kareen. "He was not. I thought he was Vorrutyer's creature."

"He chose . . . he chose to be otherwise. I think it was the most heroic act I've ever witnessed. Out of the middle of that swamp of evil and insanity, to reach for. . . ." Cordelia trailed off, embarrassed to say, *reach for redemption*. After a pause she asked, "Do you blame Admiral Vorrutyer, for Prince Serg's, uh, corruption?" As long as they were clearing the air. . . . *Nobody mentions Prince Serg. He thought to take a bloody shortcut to the Imperium, and now he's just . . . disappeared.*

"Ges Vorrutyer. . . ." Kareen's hands twisted, "found a like-minded friend in Serg. A fertile follower, in his vile amusements. Maybe not . . . all Vorrutyer's fault. I don't know."

An honest answer, Cordelia sensed. Kareen added softly, "Ezar protected me from Serg, after I became pregnant. I had not even seen my husband for over a year, when he was killed at Escobar."

Perhaps I will not mention Prince Serg again either. "Ezar was a powerful protector. I hope Aral may do as well," Cordelia offered. Ought she to refer to Emperor Ezar in the past tense already? Everybody else seemed to.

Kareen came back from some absence, and shook herself to focus. "Tea, Lady Vorkosigan?" she smiled. She touched a comm link, concealed in a jeweled pin on her shoulder, and gave domestic orders. Apparently the private interview was over. Captain Naismith must now try to figure out how Lady Vorkosigan should take tea with a princess.

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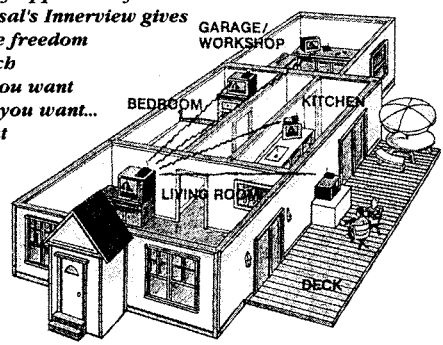

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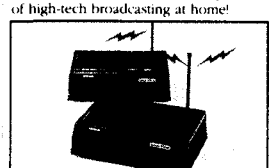

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Gregor and the bodyguard reappeared about the time the cream cakes were being served, and Gregor set about successfully charming the ladies for a second helping. Kareen drew the line firmly at thirds. Prince Serg's son seemed an utterly normal boy, if quiet around strangers. Cordelia watched him with Kareen with deep personal interest. Motherhood. Everybody did it. How hard could it be?

"How do you like your new home so far, Lady Vorkosigan?" the princess inquired, making polite conversation. Tea-table stuff; no naked faces now. Not in front of the children.

Cordelia thought it over. "The country place, south at Vorkosigan Surleau, is just beautiful. That wonderful lake — it's bigger than any open body of water on the whole of Beta Colony, yet Aral just takes it for granted. Your planet is beautiful beyond measure." *Your planet. Not my planet?* In a free association test, "home" still triggered "Beta Colony" in Cordelia's mind. Yet she could have rested in Vorkosigan's arms by the lake forever.

"The capital here—well, it's certainly more varied than anything we have at ho—on Beta Colony. Although," she laughed self-consciously, "there seems to be so many soldiers. Last time I was surrounded by that many green uniforms, I was in a POW camp."

"Do we still look like the enemy to you?" asked the princess curiously.

"Oh—you all stopped looking like the enemy to me even before the war was over. Just assorted victims, variously blind."

"You have penetrating eyes, Lady Vorkosigan." The princess sipped tea, smiling into her cup. Cordelia blinked.

"Vorkosigan House does tend to a barracks atmosphere, when Count Piotr is in residence," Cordelia commented. "All his liveried men. I think I've seen a couple of womenservants so far, whisking around corners, but I haven't caught one yet. A Barrayaran barracks, that is. My Betan service was a different sort of thing."

"Mixed," said Droushnakovi. Was that the light of envy in her eyes? "Women and men both serving."

"Assignment by aptitude test," Cordelia agreed. "Strictly. Of course the more physical jobs are skewed to the men, but there doesn't seem to be that strange obsessive status-thing attached to them."

"Respect," sighed Droushnakovi.

"Well, if people are laying their lives on the line for their community, they ought certainly to get its respect," Cordelia said equably. "I do miss my—my sister-officers, I guess. The bright women, the techs, like my pool of friends at home." There was that tricky word again: home. "There have to be bright women around here somewhere, with all these bright men. Where are they hiding?" Cordelia shut her mouth, as it suddenly occurred to her that Kareen might mistakenly construe this remark as a slur on herself. Adding *Present company excepted* would put her foot in it for sure, though.

But if Kareen so construed, she kept it to herself, and Cordelia was rescued from further potential social embarrassment by the return of Aral and Illyan. They all made polite farewells, and returned to Vorkosigan House.

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* * *

That evening Commander Illyan popped in to Vorkosigan House with Droushnakovi in tow. She clutched a large valise, and gazed about her with starry-eyed interest.

"Captain Negri is assigning Miss Droushnakovi to the Regent-consort for her personal security," Illyan explained briefly. Aral nodded approval.

Later, Droushnakovi handed Cordelia a sealed note, on thick cream paper. Brows rising, Cordelia broke it open. The handwriting was small and neat, the signature legible and without flourishes.

With my compliments, it read. *She will suit you well. Kareen.*

CHAPTER TWO

The next morning Cordelia awoke to find Vorkosigan already gone, and herself facing her first day on Barrayar without his supportive company. She decided to devote it to the shopping project that had occurred to her while watching Koudelka negotiate the spiral staircase last night. She suspected Droushnakovi would be the ideal native guide for what she had in mind.

She dressed and went hunting for her bodyguard. Finding her was not difficult; Droushnakovi was seated in the hall, just outside the bedroom door, and popped to attention at Cordelia's appearance. The girl really ought to be wearing a uniform, Cordelia reflected. The dress she wore made her near-six-foot frame and excellent musculature look heavy. Cordelia wondered if, as Regent-consort, she might be permitted her own livery, and bemused herself through breakfast mentally designing one that would set off the girl's Valkyrie good looks.

"Do you know, you're the first female Barrayaran guard I've met," Cordelia commented to her over her egg and coffee, and a kind of steamed native groats with butter, evidently a morning staple here. "How did you get into this line of work?"

"Well, I'm not a real guard, like the liveried men—"

Ah, the magic of uniforms again.

"—but my father and all three of my brothers are in the Service. It's as close as I can come to being a real soldier, like you."

Army-mad, like the rest of Barrayar. "Yes?"

"I used to study judo, for sport, when I was younger. But I was too big for the women's classes. Nobody could give me any real practice, and besides, doing all katas was so dull. My brothers used to sneak me into the men's classes with them. One thing led to another. I was all-Barrayar women's champion two years running, when I was in school. Then three years ago a man from Captain Negri's staff approached my father with a job offer for me. That's when I had weapons training. It seemed the princess had been asking for female guards for years, but they had a lot of trouble getting anyone who could pass all the tests. Although," she smiled self-deprecatingly, "the lady who assassinated Admiral Vorrutyer could scarcely be supposed to need my poor services."

Cordelia bit her tongue. "Um. I was lucky. Besides, I'd rather stay out of the physical end of things just now. Pregnant, you know."

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"Yes, milady. It was in one of Captain—"

"Negri's reports," Cordelia finished in unison with her. "I'm sure it was. He probably knew before I did."

"Yes, milady."

"Were you much encouraged in your interests, as a child?"

"Not . . . really. Everyone thought I was just odd." She frowned deeply, and Cordelia had the sense of stirring up a painful memory.

She regarded the girl thoughtfully. "Older brothers?"

Droushnakovi returned a wide blue gaze. "Why, yes."

"Figured." *And I feared Barrayar for what it did to its sons. No wonder they have trouble getting anyone to pass the tests.* "So you've had weapons training. Excellent. You can guide me on my shopping trip today."

A slightly glazed look crept over Droushnakovi's face. "Yes, milady. What sort of clothing do you wish to look at?" she asked politely, not quite concealing a glum disappointment with the interests of her "real" lady soldier.

"Where in this town would you go to buy a really good swordstick?"

The glazed look vanished. "Oh, I know just the place, where the Vor officers go, and the counts, to supply their liveried men. That is—I've never been inside. My family's not Vor, so of course we're not permitted to own personal weapons. Just Service issue. But it's supposed to be the best."

One of Count Vorkosigan's liveried guards chauffered them to the shop. Cordelia relaxed and enjoyed the view of the passing city. Droushnakovi, on duty, kept alert, eyes constantly checking the crowds all around. Cordelia had the feeling she didn't miss much. From time to time her hand wandered to check the stunner worn concealed on the inside of her embroidered bolero.

They turned into a clean narrow street of older buildings with cut stone fronts. The weapons shop was marked only by its name, *Siegling's*, in discreet gold letters. Evidently if you didn't know where you were you shouldn't be here. The liveried man waited outside when Cordelia and Droushnakovi entered the shop, a thick-carpeted, wood-grained place with a little of the aroma of the armory Cordelia remembered from her Survey ship, an odd whiff of home in an alien place. She stared covertly at the wood paneling, and mentally translated its value into Betan dollars. A great many Betan dollars. Yet wood seemed almost as common as plastic, here, and as little regarded. Those personal weapons which were legal for the upper classes to own were elegantly displayed in cases and on the walls. Besides stunners and hunting weapons, there was an impressive array of swords and knives; evidently the emperor's ferocious edicts against dueling only forbade their use, not their possession.

The clerk, a narrow-eyed, soft-treading older man, came up to them. "What may I do for you ladies?" He was cordial enough. Cordelia supposed Vor-class women must sometimes enter here, to buy presents for their masculine relations. But he might have said, What may I do for you children? In the same tone of voice. Diminutization by body language? Let it go.

"I'm looking for a swordstick, for a man about six-foot-four. Should be

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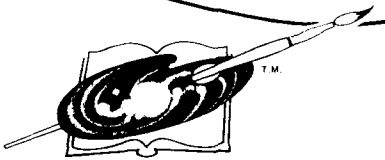

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about, oh, yea long," she estimated, calling up Koudelka's arm and leg length in her mind's eye, and gesturing to the height of her hip. "Spring-sheathed, probably."

"Yes, madam." The clerk disappeared, and returned with a sample, in an elaborately carved light wood.

"Looks a bit. . . . I don't know." *Flashy.* "How does it work?"

The clerk demonstrated the spring mechanism. The wooden sheathing dropped off, revealing a long thin blade. Cordelia held out her hand, and the clerk, rather reluctantly, handed it over for inspection.

She wriggled it a little, sighted down the blade, and handed it to her bodyguard. "What do you think?"

Droushnakovi smiled first, then frowned doubtfully. "It's not very well balanced." She glanced uncertainly at the clerk.

"Remember, you're working for me, not him," said Cordelia, correctly identifying class-consciousness in action.

"I don't think it's a very good blade."

"That's excellent Darkoi workmanship, madam," the clerk defended cooly.

Smiling, Cordelia took it back. "Let us test your hypothesis."

She raised the blade suddenly to the salute, and lunged at the wall in a neat extension. The tip penetrated and caught in the wood, and Cordelia leaned on it. The blade snapped. Blandly, she handed the pieces back to the clerk. "How do you stay in business if your customers don't survive long enough for repeat sales? Siegling's certainly didn't acquire its reputation selling toys like that. Bring me something a decent soldier can carry, not a pimp's plaything."

"Madam," said the clerk stiffly, "I must insist the damaged merchandise be paid for."

Cordelia, thoroughly irritated, said "Very well. Send the bill to my husband. Admiral Aral Vorkosigan, Vorkosigan House. While you're about it you can explain why you tried to pass off sleaze on his wife—Yeoman." This last was a guess, based on his age and walk, but she could tell from his eyes she'd struck home.

The clerk bowed profoundly. "I beg pardon, milady. I believe I have something more suitable, if milady will be pleased to wait."

He vanished again, and Cordelia sighed. "Buying from machines is so much easier. But at least the Appeal to the Irrelevant Authorities at Headquarters works just as well here as at home."

The next sample was a plain dark wood, with a finish like satin. The clerk handed it to her unopened, with another little bow. "You press the handle there, milady."

It was much heavier than the first swordstick. The sheathing sprang away at velocity, landing against the wall on the other side of the room with a satisfying thunk, almost a weapon in itself. Cordelia sighted down the blade again. A strange watermark pattern down its length shifted in the light. She saluted the wall once more, and caught the clerk's eye. "Do these come out of your salary?"

"Go ahead, milady." There was a little gleam of satisfaction in his eye. "You can't break that one."

She gave it the same test as she had the other. The tip went much further into the wood, and leaning against it

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with all her strength, she could barely bend it. Even so, there was more bend left in it; she could feel she was nowhere near the limit of its tensile strength. She handed it to Droushnakovi, who examined it lovingly.

"That's *fine*, milady. That's worthy."

"I'm sure it will be used more as a stick than as a sword. Nevertheless . . . it should indeed be worthy. We'll take this one."

As the clerk wrapped it, Cordelia lingered over a case of enamel-decorated stunners.

"Thinking of buying one for yourself, milady?" asked Droushnakovi.

"I . . . don't think so. Barrayar has enough soldiers, without importing them from Beta Colony. Whatever I'm here for, it isn't soldiering. See anything you want?"

Droushnakovi looked wistful, but shook her head, her hand going to her bolero. "Captain Negri's equipment is the best. Even Siegling's doesn't have anything better, just prettier."

They sat down three to dinner that night, late, Vorkosigan, Cordelia, and Lieutenant Koudelka. Vorkosigan's new personal secretary looked a little tired.

"What did you two do all day?" asked Cordelia.

"Herded men, mostly," answered Vorkosigan. "Prime Minister Vortala had a few votes that weren't as much in the bag as he claimed, and we worked them over, one or two at a time, behind closed doors. What you'll see tomorrow in the Council chambers isn't Barrayaran politics at work, just their result. Were you all right today?"

"Fine. Went shopping. Wait'll you see." She produced the swordstick, and stripped off the wrapping. "Just to help keep you from running Kou completely into the ground."

Koudelka looked politely grateful, over a more fundamental irritation. His look changed to one of surprise as he took the stick and nearly dropped it from the unexpected weight. "Hey! This isn't—"

"You press the handle there. Don't point it—!"

Thwack!

"—at the window." Fortunately, the sheath struck the frame, and bounced back with a clatter. Kou and Aral both jumped.

Koudelka's eyes lit up as he examined the blade, while Cordelia retrieved the sheath. "Oh, milady!" Then his face fell. He carefully resheathed it, and handed it back sadly. "I guess you didn't realize. I'm not Vor. It's not legal for me to own a private sword."

"Oh." Cordelia was crestfallen.

Vorkosigan raised an eyebrow. "May I see that, Cordelia?" He looked it over, unsheathing it more cautiously. "Hm. Am I right in guessing I paid for this?"

"Well, you will, I suppose, when the bill arrives. Although I don't think you should pay for the one I broke. I might as well take it back, though."

"I see." He smiled a little. "Lieutenant Koudelka, as your commanding officer and a vassal secundus to Ezar Vorbarra, I am officially issuing you this weapon of mine, to carry in the service of the Emperor, long may he rule." The unavoidable irony of the formal phrase tightened his mouth, but he shook off all the blackness, and handed

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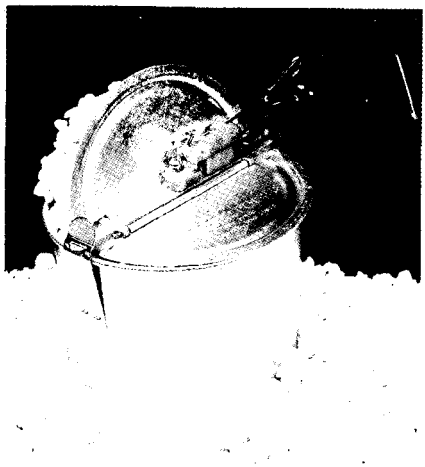

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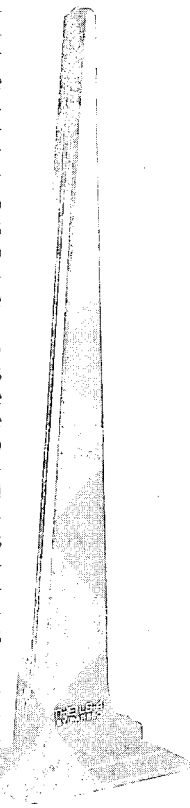

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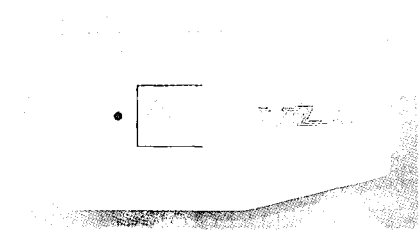

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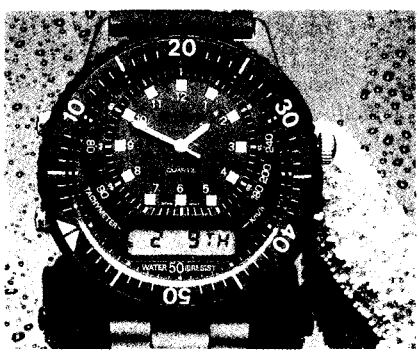

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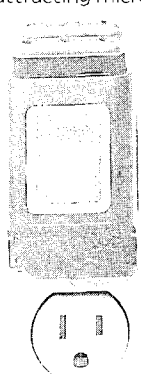

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the stick back to Koudelka, who bloomed again.

"Thank you, sir!"

Cordelia just shook her head. "I don't believe I'll ever understand this place."

"I'll have Kou find you some legal histories. Not tonight, though. He has barely time to put his notes in order from today before Vortala's due here with a couple more of his strays. You can take over part of the Count, my father's, library, Kou; we'll meet in there."

Dinner broke up. Koudelka retreated to the library to work, while Vorkosigan and Cordelia retired to the drawing room next to it to read, before Vorkosigan's evening meeting. He had yet more reports, which he ran rapidly through a hand viewer. Cordelia divided her time between a Barrayaran Russian phrase earbug, and an even more intimidating disk on child care. The silence was broken by an occasional mutter from Vorkosigan, more to himself than her, of phrases like, "Ah ha! So that's what the bastard was really up to," or "Damn, those figures are strange. Got to check it out. . . ." Or from Cordelia, "Oh, my, I wonder if all babies do that," and a periodic *thwack!* penetrating the wall from the library, which caused them to look up at each other and burst out laughing.

"Oh, dear," said Cordelia, after the third or fourth of these. "I hope I haven't distracted him unduly from his duties."

"He'll do all right, when he settles down. Vorbarra's personal secretary has taken him in hand, and is showing him how to organize himself. After Kou follows him through the funeral protocol, he should be able to tackle anything. That swordstick was a stroke of genius, by the way; thank you."

"Yes, I noticed he was pretty touchy about his handicaps. I thought it might unruffle his feathers a little."

"It's our society. It tends to be . . . rather hard on anyone who can't keep up."

"I see. Strange, now that you mention it, I don't recall seeing any but healthy-looking people, on the streets and so on, except at the hospital. No float chairs, none of those vacuous faces in the tow of their parents. . . ."

"Nor will you." Vorkosigan looked grim. "Any problems that are detectable are eliminated before birth."

"Well, we do that too. Though usually before conception."

"Also at birth. And after, in the backcountry."

"Oh."

"As for the maimed adults—"

"Good heavens, you don't practice euthanasia on them, do you?"

"Your Ensign Dubauer would not have lived, here."

Dubauer had taken disruptor fire to the head, and survived. Sort of.

"As for injuries like Koudelka's, or worse . . . the social stigma is very great. Watch him in a larger group sometime, not his close friends. It's no accident that the suicide rate among medically discharged soldiers is high."

"That's horrible."

"I took it for granted, once. Now . . . not any more. But many people still do."

"What about problems like Bothari's?"

"It depends. He was a usable mad-

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man. For the unusable. . . ." he trailed off, staring at his boots.

Cordelia felt cold. "I keep thinking I'm beginning to adjust to this place. Then I go around another corner and run headlong into something like that."

"It's only been eighty years since Barrayar made contact with the wider galactic civilization again. It wasn't just technology we lost, in the Time of Isolation. That we put back on again quickly, like a borrowed coat. But underneath it . . . we're still pretty damned naked in places. In forty-four years, I've only begun to see how naked."

Count Vortala and his "strays" came in soon after, and Vorkosigan vanished into the library. The old Count Piotr Vorkosigan, Aral's father, arrived from his district later that evening, come up to attend the full Council vote.

"Well, that's one vote he's assured of tomorrow," Cordelia joked to her father-in-law, helping him get stiffly out of his jacket in the stone-paved foyer.

"Ha. He's lucky to get it. He's picked up some damned peculiar radical notions in the last few years. If he wasn't my son, he could whistle for it." But Piotr's seamed face looked proud.

Cordelia blinked at this description of Aral Vorkosigan's political views. "I confess, I've never thought of him as a revolutionary. Radical must be a more elastic term than I thought."

"Oh, he doesn't see himself that way. He thinks he can go halfway, and then stop. I think he'll find himself riding a tiger, a few years down the road." The Count shook his head grimly. "But come, my girl, and sit down and tell me that you're well. You look well—is everything all right?"

The old Count was passionately interested in the development of his grandson-to-be. Cordelia sensed her pregnancy had raised her status with him enormously, from a tolerated caprice of Aral's to something bordering perilously on the semi-divine. He fairly blasted her with approval. It was nearly irresistible, and she never laughed at him, although she had no illusions about it.

Cordelia had found Aral's earlier sketch of his father's reaction to her pregnancy, the day she'd brought home the confirming news, to be right on target. She'd returned to the estate at Vorkosigan Surleau that summer day to search Aral out down by the boat dock. He was puttering around with his sailboat, and had the sails laid out, drying in the sun, as he squished around them in wet shoes.

He looked up to meet her smile, unsuccessful at concealing the eagerness in his eyes. "Well?" He bounced a little, on his heels.

"Well." She attempted a sad and disappointed look, to tease him, but the grin escaped and took over her whole face. "Your doctor says it's a boy."

"Ah." A long and eloquent sigh escaped him, and he scooped her up and twirled her around.

"Aral! Awk! Don't drop me." He was no taller than herself, if, um, thicker.

"Never." He let her slide down against him, and they shared a long kiss, ending in laughter.

"My father will be ecstatic."

"You look pretty ecstatic yourself."

"Yes, but you haven't seen anything until you've seen an old-fashioned Bar-

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rayaran paterfamilias in a trance over the growth of his family tree. I've had the poor old man convinced for years that his line was ending in me."

"Will he forgive me for being an offworlder plebe?"

"No insult intended, but by this time I don't think he'd have cared what *species* of wife I dragged home, as long as she was fertile. You think I'm exaggerating?" he added at her trill of laughter. "You'll see."

"Is it too early to think of names?" she asked, slightly wistful.

"No thinking to it. First-born son. It's a strict custom here. He gets named after his two grandfathers. Paternal for the first, maternal for the second."

"Ah, that's why your history is so confusing to read. I was always having to put dates next to those duplicate names, to try and keep track. Piotr Miles. Hm. Well, I guess I can get used to it. I'd been thinking of . . . something else."

"Another time, perhaps."

"Ooh, ambitious."

A short wrestling match ensued, Cordelia having previously made the useful discovery that in certain moods he was more ticklish than she. She extracted a reasonable amount of revenge, and they ended laughing on the grass in the sun.

"This is very undignified," Aral complained as she let him up.

"Afraid I'll shock Negri's fisher of men out there?"

"They're beyond shock, I guarantee."

Cordelia waved at the distant hoverboat, whose occupant steadfastly ignored the gesture. She had been at first angered, then resigned to learn that Aral was being kept under continuous observation by Imperial Security. The price, she'd supposed, of his involvement in the secret and lethal politics of the Escobar War, and the penalty for some of his less welcome outspoken opinions.

"I can see why you took up baiting them for a hobby. Maybe we ought to unbend and invite them to lunch or something. I feel they must know me so well by now, I'd like to know them." Had Negri's man recorded the domestic conversation she'd just had? Were there bugs in their bedroom? Their bathroom?

Aral grinned, but replied, "They wouldn't be permitted to accept. They don't eat or drink anything but what they bring themselves."

"Heavens, how paranoid. Is that really necessary?"

"Sometimes. Theirs is a dangerous trade. I don't envy them."

"I'd think sitting around down here watching you would constitute a nice little vacation. He's got to have a great suntan."

"The sitting around is the hardest part. They may sit for a year, and then be called to five minutes of all-out action of deadly importance. But they have to be instantly ready for that five minutes the whole year. Quite a strain. I much prefer attack to defense."

"I still don't understand why anybody would want to bother you. I mean, you're just a retired officer, living in obscurity. There must be hundreds like you, even of high Vor blood."

"Hm." He'd rested his gaze on the distant boat, avoiding answer, then jumped to his feet. "Come on. Let's go spring the good news on Father."

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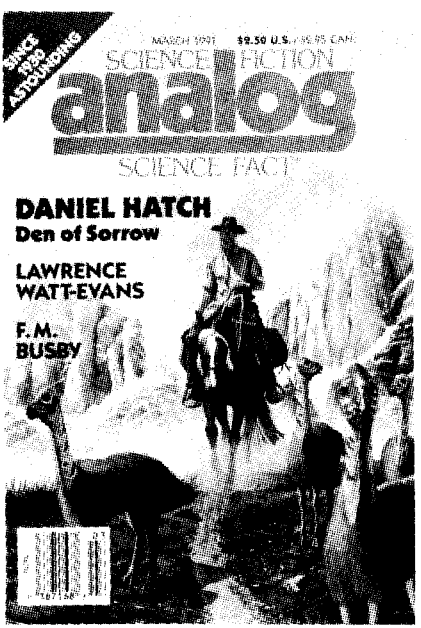

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Well, she understood it now. Count Piotr drew her hand through his arm, and carried her off to the dining room, where he ate a late supper between demands for the latest obstetrical report, and pressed fresh garden dainties upon her that he'd brought with him from the country. She ate grapes obediently.

After the Count's supper, walking arm-in-arm with him into the foyer, Cordelia's ear was caught by the sound of raised voices coming from the library. The words were muffled but the tones were sharp, chop-cadenced. Cordelia paused, disturbed.

After a moment the—argument? —stopped, the library door swung open, and a man stalked out. Cordelia could see Aral and Count Vortala through the aperture. Aral's face was set, his eyes burning. Vortala, an age-shrunken man with a balding liver-spotted head fringed with white, was brick-pink to the top of his naked scalp. With a curt gesture the man collected his waiting liveried retainer, who followed smartly, blank-faced.

The curt man was about forty years old, Cordelia guessed, dressed expensively in the upper-class style, dark-haired. He was rendered a bit dish-faced by a prominent forehead and jaw that his nose and moustache had trouble overpowering. Neither handsome nor ugly, in another mood one might call him strong-featured. Now he just looked sour. He paused, coming upon Count Piotr in the foyer, and managed—just barely—a polite nod of greeting. "Vorkosigan," he said thickly. A reluctant *good evening* was encoded in his jerky half-bow.

The old Count tilted his head in return, eyebrows up. "Vordarian." His tone made the name an inquiry.

Vordarian's lips were tight, his hands clenching in unconscious rhythm with his jaw. "Mark my words," he ground out, "you, and I, and every other man of worth on Barrayar will live to regret tomorrow."

Piotr pursed his lips, wariness in the crow's-feet corners of his eyes. "My son will not betray his class, Vordarian."

"You blind yourself." His stare cut across Cordelia, not lingering long enough to be construed as an insult, but cold, very cold, repelling introduction. With effort, he made the minimum courtesy of a farewell nod, turned, and exited the front door with his retainer-shadow.

Aral and Vortala emerged from the library. Aral drifted to the foyer to stare moodily into the darkness through the etched glass panels flanking the door. Vortala placed a placating hand on his sleeve.

"Let him go," said Vortala. "We can live without his vote tomorrow."

"I don't plan to go running down the street after him," Aral snapped. "Nevertheless . . . next time, save your wit for those with the brains to appreciate it, eh?"

"Who was that irate fellow?" asked Cordelia lightly, trying to lift the black mood.

"Count Vidal Vordarian." Aral turned from the glass panel back to her, and managed a smile for her benefit. "Commodore Count Vordarian. I used to work with him from time to time when I was on the General Staff. He is now a leader in what you might call the next-to-most

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conservative party on Barrayar; not the back-to-the-Time-of-Isolation loonies, but, shall we say, those honestly fearing all change is change for the worse." He glanced covertly at Count Piotr.

"His name was mentioned frequently, in speculation about the upcoming Regency," Vortala commented. "I rather fear he may have been counting on it for himself. He's made great effort to cultivate Kareen."

"He should have been cultivating Ezar," said Aral dryly. "Well . . . maybe he'll come down out of the air overnight. Try him again in the morning, Vortala—a little more humbly this time, eh?"

"Coddling Vordarian's ego could be a full-time task," grumbled Vortala. "He spends too damn much time studying his family tree."

Aral grimaced agreement. "He's not the only one."

"He is to hear him tell it," growled Vortala.

CHAPTER THREE

The next day Cordelia had an official escort to the full Joint Council session in the person of Captain Lord Padma Xav Vorpatril. He turned out to be not only a member of her husband's new staff, but also his first cousin, son of Aral's long-dead mother's younger sister. Lord Vorpatril was the first close relative of Aral's Cordelia had encountered besides Count Piotr. It wasn't that Aral's relatives were avoiding her, as she might have feared; he had a real dearth of them. He and Vorpatril were the only surviving children of the previous generation, of whom Count Piotr was himself the last living representative. Vorpatril was a big cheerful man of about thirty-five, clean-cut in his dress greens. He had also, she discovered shortly, been one of her husband's junior officers during his first captaincy, before Vorkosigan's military successes of the Komarr campaign and its politically ruinous aftermath.

She sat with Vorpatril on one side and Droushnakovi on the other, in an ornate-railed gallery overlooking the Council chamber. The chamber itself was a surprisingly plain room, though heavy with what still seemed to Cordelia's Betan eye to be incredibly luxurious wood panelling. Wooden benches and desks ringed the room. Morning light poured through stained-glass windows high in the east wall. The colorful ceremonies were played out below with great punctilio.

The ministers wore archaic-looking black and purple robes set off by gold chains of office. They were outnumbered by the nearly sixty district counts, even more splendid in scarlet and silver. A sprinkling of men young enough to be on active service in the military wore the red and blue parade uniform. Vorkosigan had been right in describing the parade uniform as gaudy, Cordelia reflected, but in the wonderful setting of this ancient room the gaud seemed most appropriate. Vorkosigan looked quite good in his set, she thought.

Prince Gregor and his mother were seated on a dais to one side of the chamber. The princess wore a black gown shot with silver decoration, high-necked and long-sleeved. Her dark-haired son looked rather like an elf in his red and blue uniform. Cordelia thought he fidg-

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eted remarkably little, under the circumstances.

The emperor, too, had a ghostly presence, over closed circuit comm link from the Imperial Residence. Ezar was shown in the holovid seated, in full uniform, at what physical cost Cordelia could not guess, the tubes and monitor leads piercing his body concealed at least from the vid pick-up. His face was paper-white, his skin almost transparent, as if he were literally fading from the stage he had dominated for so long.

The gallery was crammed with wives, staff, and guards. The women were elegantly dressed and decorated with jewelry, and Cordelia studied them with interest, then turned her attention back to pumping Vorpatril for information.

"Was Aral's appointment as Regent a surprise to you?" she asked.

"Not really. A few people took that resignation-and-retirement business after the Escobar mess seriously, but I never did."

"He meant it seriously, I thought."

"Oh, I don't doubt it. The first person Aral fools with that prosey-stone-soldier routine is himself. It's the sort of man he always wanted to be, I think. Like his father."

"Hm. Yes, I had noticed a certain political bent to his conversations. In the middle of the most extraordinary circumstances, too. Marriage proposals, for instance."

Vorpatril laughed. "I can just picture it. When he was young he was a real conservative—if you wanted to know what Aral thought about anything, all you had to do was ask Count Piotr, and multiply by two. But by the time we served together, he was getting . . . um . . . strange. If you could get him going. . . ." There was a certain wicked reminiscence in his eye, which Cordelia promptly encouraged.

"How? I thought political discussion was forbidden to officers."

He snorted. "I suppose they could forbid breathing with about as much chance of success. The dictum is, shall we say, sporadically enforced. Aral stuck to it, though, unless Rulf Vorhalas and I took him out and got him really relaxed."

"Aral? Relaxed?"

"Oh, yes. Now, Aral's drinking was notable—"

"I thought he was a terrible drinker. No stomach for it."

"Oh, that's what was notable. He seldom drank. Although he went through a bad period after his first wife died, when he used to run around with Ges Vorrutyer a lot . . . um . . ." he glanced sideways, and took another tack. "Anyway, it was dangerous to get him too relaxed, because then he'd go all depressed and serious, and then it didn't take a thing to get him on to whatever current injustice or incompetence or insanity was rousing his ire. God, the man could talk. By the time he'd had his fifth drink—just before he slid under the table for the night—he'd be declaiming revolution in iambic pentameter. I always thought he'd end up on the political side someday." He chuckled, and looked rather lovingly at the stocky red-and-blue clad figure seated with the counts on the far side of the chamber.

The Joint Council vote of confirmation for Vorkosigan's Imperial appointment was a curious affair, to Cordelia's mind. She hadn't imagined it possible

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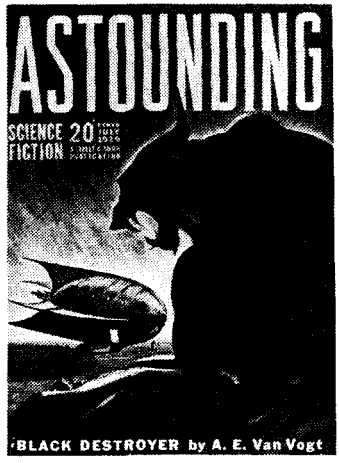

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to get seventy-five Barrayarans to agree on which direction their sun rose in the morning, but the tally was nearly unanimous in favor of Emperor Ezar's choice. The exceptions were five set-jawed men who abstained, four loudly, one so weakly the Lord Guardian of the Speaker's Circle had to ask him to repeat himself. Even Count Vordarian voted yea, Cordelia noticed—perhaps Vortala had managed to repair last night's breach in some early-morning meeting after all. It all seemed a very auspicious and encouraging start to Vorkosigan's new job, anyway, and she said as much to Lord Vorpatril.

"Uh . . . yes, milady," said Lord Vorpatril after a sideways smile at her. "Emperor Ezar made it clear he wanted united approval."

His tone made it clear she was missing cues, again. "Are you trying to tell me some of those men would rather have voted no?"

"That would be imprudent of them, at this juncture."

"Then the men who abstained . . . must have some courage of conscience." She studied the little group with new interest.

"Oh, *they're* all right," said Vorpatril.

"What do you mean? They are the opposition, surely."

"Yes, but they're the open opposition. No one plotting serious treason would mark himself so publicly. The fellows Aral will need to guard his back from are in the other mob, among the yes-men."

"Which ones?" Cordelia's brow wrinkled in worry.

"Who knows?" Lord Vorpatril shrugged, then answered his own question, "Negri, probably."

They were surrounded by a ring of empty seats. Cordelia hadn't been sure if it was for security or courtesy. Evidently the second, for two latecomers, a man in commander's dress greens and a younger one in rich-looking civilian clothes, arrived and apologetically sat in front of them. Cordelia thought they looked like brothers, and had the guess confirmed when the younger said, "Look, there's Father, three seats behind old Vortala. Which one's the new Regent?"

"The bandy-legged character in the red-and-blues, just sitting down to Vortala's right."

Cordelia and Vorpatril exchanged a look behind their backs, and Cordelia put a finger to her lips. Vorpatril grinned and shrugged.

"What's the word on him in the Service?"

"Depends on who you ask," said the commander. "Sardi thinks he's a strategic genius, and dotes on his communiques. He's been all over the place. Every brushfire in the last twenty-five years seems to have his name in it someplace. Uncle Rulf used to think the world of him. On the other hand, Niels, who was at Escobar, said he was the most cold-blooded bastard he'd ever met."

"I hear he has a reputation as a secret progressive."

"There's nothing secret about it. Some of the senior Vor officers are scared to death of him. He's been trying to get Father and Vortala with him on that new tax ruling."

"Oh, yawn."

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"It's the direct Imperial tax on inheritances."

"Ouch! Well, that wouldn't hit *him*, would it? The Vorkosigans are so damn poor. Let Komarr pay. That's why we conquered it, isn't it?"

"Not exactly, my fraternal ignoramus. Have any of you town clowns met his Betan frill yet?"

"Men of fashion, sirrah," corrected his brother. "Not to be confused with you Service grubs."

"No danger of that. No, really. There are the damnedest rumors circulating about her, Vorkosigan, and Vorrutyer at Escobar, most of which contradict each other. I thought Mother might have a line on it."

"She keeps a low profile, for somebody who's supposed to be three meters tall and eat battle cruisers for breakfast. Scarcely anybody's seen her. Maybe she's ugly."

"They'll make a pair, then. Vorkosigan's no beauty either."

Cordelia, vastly amused, hid a grin behind her hand, until the commander said, "I don't know who that three-legged spastic is he has trailing him, though. Staff, do you suppose?"

"You'd think he could do better than that. What a mutant. Surely Vorkosigan has the pick of the Service, as Regent."

She felt she'd received a body blow, so great was the unexpected pain of the careless remark. Captain Lord Vorpatril scarcely seemed to notice it. He had heard it, but his attention was on the floor below, where oaths were being made. Droushnakovi, surprisingly, blushed, and turned her head away.

Cordelia leaned forward. Words boiled up within her, but she chose only a few, and fired them off in her coldest captain's voice.

"Commander. And you, whoever you are." They looked back at her, surprised at the interruption. "For your information, the gentleman in question is Lieutenant Koudelka. And there are no better officers. Not in anybody's service."

They stared at her, irritated and baffled, unable to place her in their scheme of things. "I believe this was a private conversation, madam," said the commander stiffly.

"Quite so," she returned, equally stiffly, still boiling. "For eavesdropping, unavoidable as it was, I beg your pardon. But for that shameful remark upon Admiral Vorkosigan's secretary, *you* must apologize. It was a disgrace to the uniform you both wear and the service to your emperor you both share." She kept her voice very low, almost hissing. She was trembling. *An overdose of Barrayar. Get hold of yourself.*

Vorpatril's wandering attention was drawn, startled, back to her by this speech. "Here, here," he remonstrated. "What is this—"

The commander turned around further. "Oh, Captain Vorpatril, sir. I didn't recognize you at first. Um . . ." he gestured helplessly at his red-haired attacker, as if to say, Is this lady with you? And if so, can't you keep her under control? He added coldly, "We have not met, madam."

"No, but I don't go 'round flipping over rocks to see what's living underneath." She was instantly conscious of having been lured into going too far. With difficulty, she put a lid on her temper. It wouldn't do to be making new

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enemies for Vorkosigan at the very moment he was taking up his new duties.

Vorpatril, waking up to his responsibilities as escort, began, "Commander, you don't know who—"

"Don't . . . introduce us, Lord Vorpatril," Cordelia interrupted him. "We should only embarrass each other further." She pressed thumb and forefinger to the bridge of her nose, closing her eyes and gathering more conciliating words. *And I used to pride myself on keeping my temper.* She looked up at their furious faces.

"Commander. My lord." She correctly deduced the young man's title from his reference to his father, sitting among the counts. "My words were hasty and rude, and I take them back. I had no right to comment on a private conversation. I apologize. Most humbly."

"As well you should," snapped the young lord.

His brother had more self-control, and replied reluctantly, "I accept your apology, madam. I presume the lieutenant is some relative of yours. I apologize for whatever insult you felt was implied."

"And I accept your apology, Commander. Although Lieutenant Koudelka is not a relation, but only my second-dearest . . . enemy." She paused, and they exchanged frowns, hers of irony, his of puzzlement. "I would ask a favor of you, however, sir. Don't let a comment like that fall in Admiral Vorkosigan's hearing. Koudelka was one of his officers aboard the *General Vorkraft*, and was wounded in his defense during that political mutiny last year. He loves him as a son."

The commander was calming down, although Droushnakovi still looked as if she had a bad taste in her mouth. He smiled a little. "Are you implying I'd find myself doing guard duty on Kyril Island?"

What was Kyril Island? Some distant and unpleasant outpost, apparently. "I . . . doubt it. He wouldn't use his office to carry out a personal grudge. But it would cause him unnecessary pain."

"Madam." She had puzzled him thoroughly now, this plain-looking woman, so out of place in the glittering gallery. He turned back with his brother to watch the show below, and all maintained a sticky silence for another twenty minutes, until the ceremonies stopped for lunch. The crowds in both gallery and floor broke away to meet in the corridors of power.

She found Vorkosigan, Koudelka at his side, speaking with his father Count Piotr and another older man in count's robes. Vorpatril delivered her and vanished, and Aral greeted her with a tired smile.

"Dear Captain, are you holding up all right? I want you to meet Count Vorhalas. Admiral Rulf Vorhalas was his younger brother. We must go shortly, we're scheduled for a private lunch with the princess and Prince Gregor."

Count Vorhalas bowed profoundly over her hand. "Milady. I'm honored."

"Count. I . . . only saw your brother briefly. But Admiral Vorhalas struck me as a man of outstanding worth." *And my side blew him away.* She felt queasy, with her hand in his, but he seemed to hold no personal animosity.

"Thank you, milady. We all thought

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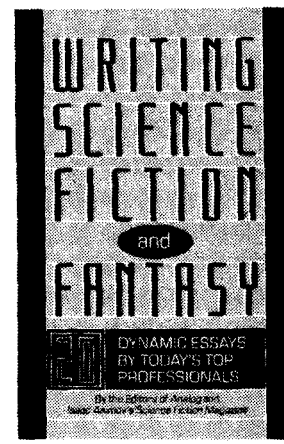

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so. Ah, there are the boys. I promised them an introduction. Evon is itching for a place on the Staff, but I told him he'd have to earn it. I wish Carl had as much interest in the service. My daughter will be mad with jealousy. You've stirred up all the girls, you know, milady."

The count darted away to round up his sons. *Oh, God,* thought Cordelia. *It would have to be them.* The two men who had sat before her in the gallery were presented to her. They both blanched, and bowed nervously over her hand.

"But you've met," said Vorkosigan. "I saw you talking in the gallery. What did you find to discuss so animatedly, Cordelia?"

"Oh . . . geology. Zoology. Courtesy. Much on courtesy. We had quite a wide-ranging discussion. We each of us taught the other something, I think." She smiled, and did not flick an eyelid.

Commander Evon Vorhalas, looking rather ill, said, "Yes. I've . . . had a lesson I'll never forget, milady."

Vorkosigan was continuing the introductions. "Commander Vorhalas, Lord Carl; Lieutenant Koudelka."

Koudelka, loaded with plastic flimsies, disks, the baton of the commander-in-chief of the armed forces that had just been presented to Vorkosigan as Regent-elect, and his own stick, and uncertain whether to shake hands or salute, managed to drop them all and do neither. There was a general scramble to retrieve the load, then Koudelka went red, bending awkwardly after it. Droushnakovi and he put a hand on his stick at the same time.

"I don't need your help, Miss," Koudelka snarled at her in a low voice, and she recoiled to go stand rigidly behind Cordelia.

Commander Vorhalas handed him back some disks. "Pardon me, sir," said Koudelka. "Thank you."

"Not at all, Lieutenant. I was almost hit by disruptor fire once. Scared the hell out of me. You are an example to us all."

"It . . . didn't hurt, sir."

Cordelia, who knew from personal experience that this was a lie, held her peace, satisfied. The group broke up for its separate destinations. Cordelia paused before Evon Vorhalas.

"Nice to meet you, Commander. I predict you will go far, in your future career—and not in the direction of Kyril Island."

Vorhalas smiled tightly. "I believe you will too, milady." They exchanged wary and respectful nods, and Cordelia turned to take Vorkosigan's arm, and follow him to his next task, trailed by Koudelka and Droushnakovi.

The Barrayaran emperor slipped into his final coma a week later, but lingered on another week beyond that. Aral and Cordelia were routed out of bed at Vorkosigan House in the early hours of the morning by a special messenger from the Imperial Residence, with the simple words, "The doctor thinks it's time, sir." They dressed hastily, and accompanied the messenger back to the beautiful old chamber Ezar had chosen for the last month of his life, its priceless antiques cluttered over with offworlder medical equipment.

The room was crowded, with the old man's personal physicians, Vortala,

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Count Piotr and themselves, the princess and Prince Gregor, several ministers, and some men from the General Staff. They kept a quiet, standing deathwatch for almost an hour before the still, decayed figure on the bed took on, almost imperceptibly, an added stillness. Cordelia thought it a gruesome scene to subject the boy to, but his presence seemed ceremonially necessary. Very quietly, beginning with Vorkosigan, they turned to kneel and place their hands between Gregor's, to renew their oaths of fealty.

Cordelia, too, was guided by Vorkosigan to kneel before the boy. The prince—emperor—had his mother's hair, but hazel eyes like Ezar and Serg, and Cordelia found herself wondering how much of his father, or his grandfather, was latent in him, its expression waiting on the power that would come with age. *Do you bear curses in your chromosomes, child?* she wondered as her hands were placed between his. Cursed or blessed, regardless, she gave him her oath. The words seemed to cut her last tie to Beta Colony; it parted with a *ping!* audible only to her.

I am a Barrayaran now. It had been a long strange journey, that began with a view of a pair of boots in the mud, and ended in these clean child's hands. *Do you know I helped kill your father, boy? Will you ever know? Pray not.* She wondered if it was delicacy or oversight, that she had never been required to give oath to Ezar Vorbarra.

Of all present, only Captain Negri wept. Cordelia only knew this because she was standing next to him, in the darkest corner of the room, and saw him twice brush his face with the back of his hand. His face grew suffused, and more lined, for a time; when he stepped forward to take his oath, it had returned to his normal blank hardness.

The five days of funeral ceremonies that followed were grueling for Cordelia, but not, she was led to understand, so grueling as the ones had been for Crown Prince Serg, which had run for two weeks, despite the absence of a body for a centerpiece. The public view was that Prince Serg had died the death of a heroic soldier. By Cordelia's count, only five human beings knew the whole truth of that subtle assassination. No, four, now that Ezar was no more. Perhaps the grave was the safest repository of Ezar's secrets. Well, the old man's torment was over now, his time done, his era passing.

There was no coronation as such for the boy emperor, but instead a surprisingly businesslike, if elegantly garbed, several days spent back in the Council chambers collecting personal oaths from ministers, counts, a host of their relatives, and anybody else who had not already made their vows in Ezar's death chamber. Vorkosigan too received oaths, seeming to grow burdened with their accumulation as if each had a physical weight.

The boy, closely supported by his mother, held up well. Kareen made sure Gregor's hourly breaks to rest were respected by the busy, impatient men who had thronged to the capital to discharge their obligation. The strangeness of the Barrayaran government system, with all its unwritten customs, pressed on Cordelia not so much at first glance, but gradually. And yet it seemed to work for them, somehow. They made it work.

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Pretending a government into existence. Perhaps all governments were such consensus fictions, at their hearts.

After the spate of ceremonies had died down, Cordelia began at last to establish her domestic routine at Vorkosigan House. Not that there was that much to do. Most days Vorkosigan left at dawn, Koudelka in tow, and returned after dark, to snatch a cold supper and lock himself in the library, or see men there, until bedtime. His long hours were a start-up cost, Cordelia told herself. He would settle in, become more efficient, when everything wasn't all for the first time. She remembered her first ship command in the Betan Astronomical Survey—not so very long go—and her first few months of nervous hyperpreparedness. Later, the painfully studied tasks had become automatic, then nearly unconscious, and her personal life had reemerged. Aral's would too. She waited patiently, and smiled when she did see him.

Besides, she had a job. Gestating. It was a task of no little status, judging from the cosseting she received from everyone from Count Piotr down to the kitchen maid who brought her nutritious little snacks at odd hours. She hadn't received this much approval even when she'd returned from a year-long survey mission with a zero-accident record. Reproduction seemed far more enthusiastically encouraged here than on Beta Colony.

After lunch one afternoon she lay with her feet up on a sofa in a shaded patio between the house and its back garden—gestating assiduously—and reflected upon the assorted reproductive customs of Barrayar versus Beta Colony. Gestation in uterine replicators, artificial wombs, seemed unknown here. On Beta Colony replicators were the most popular choice by three to one, but a large minority stood by claiming psycho-social advantages to the old-fashioned natural method. Cordelia had always assumed that when her turn came, she'd have her own kid cooked up in a replicator bank at the start of a Survey mission, to be ready and waiting for her arms upon her return. If she returned—there was always that possible catch, exploring the blind unknown. And assuming, also, that she could nail down an interested co-parent with whom to pool, willing and able to pass the physical, psychological, and economic tests and take the course to qualify for a parent's license.

Aral was going to be a suberb co-parent, she was certain. If he ever touched down again, from his new high place. Surely the first rush must be over soon. It was a long fall from that high place, with nowhere to land. Aral was her safe haven, if he fell first . . . she wrenched her meditations firmly into more positive channels.

Now, family *size;* that was the real, secret, wicked fascination of Barrayar. There were no legal limits here, no certificates to be earned, no third-child variances to be scrimped for; no rules, in fact, at all. Cordelia wriggled her toes and cuddled into the cushions, afloat on an atavistic cloud of genetic greed. *Herds* of little Vorkosigans . . . She could have a daughter. Not just one, but two—sisters! Cordelia had never had a sister. Captain Vorpatril's wife had two, she'd said.

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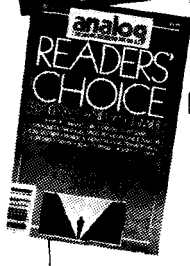

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Cordelia had met Lady Vorpatril at one of the rare evening political-social events at Vorkosigan House. The affair was managed smoothly by the Vorkosigan House staff. All Cordelia had to do was show up appropriately dressed (she had acquired more clothes), smile a lot, and keep her mouth shut. She listened with fascination, trying to puzzle out yet more about How Things Were Done Here.

Alys Vorpatril, too, was pregnant. Lord Vorpatril had sort of stuck them together and ducked out. Naturally, they talked shop. Lady Vorpatril mourned much at her personal discomforts. Cordelia decided she herself must be fortunate; the anti-nausea med, the same chemical formulation that they used at home, worked, and she was only naturally tired, not from the weight of the still-tiny baby but from the surprising metabolic load. *Peeing for two* was how Cordelia thought of it. Well, after five-space navigational math, how hard could motherhood be?

Leaving aside Alys's whispered obstetrical horror stories, of course. Hemorrhages, strokes, kidney failure, birth injuries, oxygen interruption to fetal brains, infant heads grown larger than pelvic diameters, and a spasming uterus laboring both mother and child to death. . . . Medical complications were only a problem if one was somehow caught alone and isolated at term, and with these mobs of guards about that wasn't likely to happen to her. Bothari as a midwife? Bemusing thought. She shuddered.

She rolled over again on the lawn sofa, her brow creasing. Ah, Barrayar's primitive medicine. True, moms had popped kids for hundreds of thousands of years, pre-space-flight, with less help than what was available here. Yet the niggling worry gnawed still, *Maybe I ought to go home for the birth.*

No. She was Barrayaran now, oath-sworn like the rest of the lunatics. It was a two-month journey. And besides, as far as she knew there was still an arrest warrant outstanding for her, charging military desertion, suspicion of espionage, fraud, anti-social violence—she probably shouldn't have tried to drown that idiot army psychiatrist in her aquarium, Cordelia supposed, sighing in memory of her harried and disordered departure from Beta Colony. Would her name ever be cleared? Not while Ezar's secrets stayed chambered in four skulls, surely.

No. Beta Colony was closed to her, had driven her out. Barrayar held no monopoly on political idiocy, that much was certain.

I can handle Barrayar. Aral and I. You bet.

It was time to go in. The sun was giving her a slight headache.

CHAPTER FOUR

One aspect of her new life as Regent-consort that Cordelia found easier to deal with than she'd anticipated was the influx of personal guards into their home. Her experience in the Betan Survey, and Vorkosigan's in the Barrayaran military service, had given them both practice with life in close quarters. It didn't take Cordelia long to start to know the persons in the uniforms, and take them on their own terms. The guards were a lively young group, hand-picked for their service and proud of it.

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Although when Piotr was also in residence, with all his liveried men including Bothari, the sense it gave Cordelia of living in a barracks became acute.

It was the Count who first suggested the informal hand-to-hand combat tournament between Illyan's men and his own. In spite of a vague mutter from the security commander about free training at the emperor's expense, a ring was set up in the back garden, and the contest quickly became a weekly tradition. Even Koudelka was roped in, as referee and expert judge, with Piotr and Cordelia as cheering sections. Vorkosigan attended whenever time permitted, to Cordelia's gratification; she felt he needed the break in the grinding routine of government business to which he subjected himself daily.

Cordelia was settling down on the upholstered lawn sofa to watch the show one sunny autumn morning, attended by her handmaiden, when she suddenly remarked, "Why aren't you playing, Drou? Surely you need the practice as much as any of them. The excuse for this thing in the first place—not that you Barrayarans seem to need an excuse to practice mayhem—was that it was supposed to keep everybody on their toes."

Droushnakovi looked longingly at the ring, but said, "I wasn't invited, milady."

"A rude oversight on somebody's part. Hm. Tell you what—go change your clothes. You can be my team. Aral can root for his own today. A proper Barrayaran contest should have at least three sides anyway, it's traditional."

"Do you think it will be all right?" she asked doubtfully. "They might not like it."

The *they* in question were what Droushnakovi called the "real" guards, the liveried men.

"Aral won't mind. Anyone else who objects can argue with him. If they dare." Cordelia grinned, and Droushnakovi grinned back, and dashed off.

Aral arrived to settle comfortably beside her, and she told him of her plan. He raised an eyebrow. "Betan innovations? Well, why not? Brace yourself for chaff, though."

"I'm braced. They won't be as inclined to make jokes if she can pound a few of them. I think she can—on Beta Colony that girl would be a commando officer by now. All that natural talent is wasted toddling around after me all day. If she can't—well, then she shouldn't be guarding me anyway, eh?" She met his eyes.

"Point taken. . . . I'll make sure Koudelka puts her in the first round against someone of her own height and weight class. In absolute terms she's a bit on the small side."

"She's bigger than you are."

"In height. I imagine I have a few kilos on her in weight. Nevertheless, your wish is my command. Oof." He climbed back to his feet, and went to enter Droushnakovi on Koudelka's list for the lists. Cordelia could not hear what they said to each other, across the garden, but supplied her own dialogue from gesture and expression, murmuring: "Aral: Cordelia wants Drou to play. Kou: Aw! Who wants *gurls?* Aral: Tough. Kou: They mess everything up, and besides, they cry a lot. Sergeant Bothari will squash her—hm, I do hope that's what that gesture means, otherwise you're getting obscene, Kou—wipe

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that smirk off your face, Vorkosigan —Aral: The little woman insists. You know how henpecked I am. Kou: Oh, all right. Phooey. Transaction complete: the rest is up to you, Drou."

Vorkosigan rejoined her. "All set. She'll start against one of father's men."

Drou returned, attired in loose slacks and a knit shirt, as close to the men's workout suits as her wardrobe could provide. The Count came out to consult with Sergeant Bothari, his team leader, and find a place to warm his bones in the sun beside them.

"What's this?" Piotr asked, as Koudelka called Droushnakovi's name for the second pair up. "Are we importing Betan customs now?"

"The girl has a lot of natural talent," Vorkosigan explained. "Besides, she needs the practice as much as any of them—more; she has the most important job of any of them."

"You'll be wanting women in the Service, next," complained Piotr. "Where will it end? That's what I'd like to know."

"What's wrong with women in the Service?" Cordelia asked, baiting him a little.

"It's unmilitary," snapped the old man.

" 'Military' is whatever wins the war, I should think." She smiled blandly. A small friendly warning pinch from Vorkosigan restrained her from rubbing in the point any harder.

In any case it wasn't necessary. Piotr turned to watch his player, saying only, "Humph."

The Count's player carelessly underestimated his opponent, and took the first fall for his error. It woke him up considerably. The onlookers shouted raucous comments. He pinned her on the next fall.

"Koudelka counted a bit fast there, didn't he?" asked Cordelia, as the Count's player let Droushnakovi up after the decision.

"Mm. Maybe," said Vorkosigan in a noncommittal tone.

"She pulls her punches a bit, too, I notice. She'll never make it to the next round if she keeps doing that in this company."

On the next encounter, the deciding one for the two-out-of-three, Droushnakovi applied a successful arm-bar, but let it slip away from her.

"Oh, too bad," murmured the Count cheerfully.

"You should have let him break it!" cried Cordelia, getting more and more involved. The Count's player took a soft and sloppy fall. "Call it, Kou!" But the referee, leaning on his stick, let it pass. In any case, Droushnakovi spotted an opportunity for a choke, and grabbed it.

"Why doesn't he tap out?" asked Cordelia.

"He'd rather pass out," replied Aral. "That way he won't have to listen to his friends."

Droushnakovi was beginning to look doubtful, as the face clamped under her arm turned a dusky purple. Cordelia could see release coming, and leaped up to shout, "Hang on, Drou! Don't let him fake you out!" Droushnakovi took a firmer hold, and the figure stopped struggling.

"Go ahead and call it, Koudelka," called Piotr, shaking his head ruefully.

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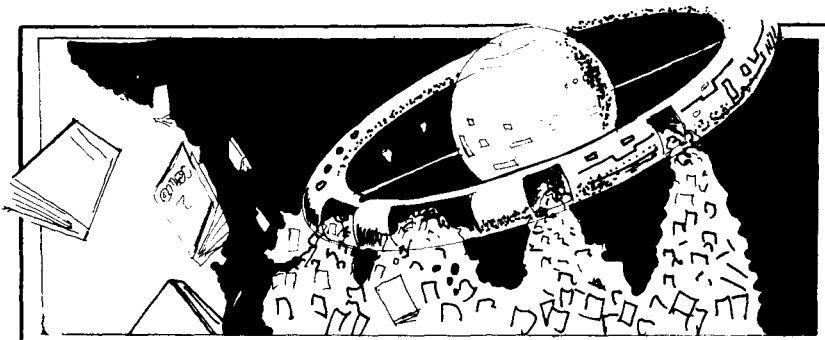

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"He has to be on duty tonight." And so the round went to Droushnakovi.

"Good work, Drou!" said Cordelia as Droushnakovi returned to them. "But you've got to be more aggressive. Release your killer instincts."

"I agree," said Vorkosigan unexpectedly. "That little hesitation you display could be deadly—and not just for yourself." He held her eye. "You're practicing for the real thing here, although we all pray that no such situation occurs. The kind of all-out effort it takes should be absolutely automatic."

"Yes, sir. I'll try, sir."

The next round featured Sergeant Bothari, who flattened his opponent twice in rapid succession. The defeated crawled out of the ring. Several more rounds went by, and it was Droushnakovi's turn again, this time with one of Illyan's men.

They connected, and in the struggle he goosed her effectively, loosing catcalls from the audience. In her angry distraction, he pulled her off-balance for a fairly clean fall.

"Did you see that!" cried Cordelia to Aral. "That was a dirty trick!"

"Mm. It wasn't one of the eight forbidden blows, though. You couldn't disqualify him on it. Nevertheless . . ." he motioned Koudelka for a time-out, and called Droushnakovi over for a quiet word.

"We saw the blow," he murmured. Her lips were tight and her face red. "Now, as milady's champion, an insult to you is in some measure an insult to her. Also a very bad precedent. It is my desire that your opponent not leave the ring conscious. How, is your problem. You may take that as an order, if you like. And don't worry needlessly about breaking bones, either," he added blandly.

Droushnakovi returned to the ring with a slight smile on her face, eyes narrowed and glittering. She followed a feint with a lightning kick to her opponent's jaw, a punch to his belly, and a low body blow to his knees that brought him down with a boom on the matting. He did not get up. There was a slightly shocked silence.

"You're right," said Vorkosigan. "She was pulling her punches."

Cordelia smiled smugly, and settled herself more comfortably. "Thought so."

The next round to come up for Droushnakovi was the semi-final, and it was the luck of the draw that her opponent was Sergeant Bothari.

"Hm," murmured Cordelia to Vorkosigan. "I'm not sure about the psychodynamics of this. Is it safe? I mean for both of them, not just for her. And not just physically."

"I think so," he replied, equally quietly. "Life in the Count's service has been a nice, quiet routine for Bothari. He's been taking his medication. I think he's in pretty good shape at the moment. And the atmosphere of the practice ring is a safe, familiar one for him. It would take more tension than Drou can provide to flip him out."

Cordelia nodded, satisfied, and settled back to watch the slaughter. Droushnakovi looked nervous.

The start was slow, with Droushnakovi mainly concentrating on staying out of reach. Swinging around to watch, Lieutenant Koudelka accidently pressed the release of his swordstick, and the

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cover shot off into the bushes. Bothari was distracted for an instant, and Drou struck, low and fast. Bothari landed clean with a firm impact, although he rolled immediately to his feet with scarcely a pause.

"Oh, good throw!" cried Cordelia ecstatically. Drou looked quite as amazed as everyone else. "Call it, Kou!"

Lieutenant Koudelka frowned. "It wasn't a fair throw, milady." One of the Count's men retrieved the cover, and Koudelka resheathed the weapon. "It was my fault. Unfair distraction."

"You didn't call it unfair distraction a while ago," Cordelia objected.

"Let it go, Cordelia," said Vorkosigan quietly.

"But he's cheating her out of her point!" she whispered back furiously. "And what a point! Bothari's been tops in every round to date."

"Yes. It took six months practice on the old *General Vorkraft* before Koudelka ever threw him."

"Oh. Hm." That gave her pause. "Jealousy?"

"Haven't you seen it? She has everything he lost."

"I have seen he's been blasted rude to her on occasion. It's a shame. She's obviously—"

Vorkosigan held up a restraining finger. "Talk about it later. Not here."

She paused, then nodded in agreement. "Right."

The round went on, with Sergeant Bothari putting Drou practically through the mat, twice, quickly, and then dispatching his final challenger with almost equal ease.

A conference of players on the other side of the garden sent Koudelka limping over as an emissary.

"Sir? We were wondering if you would go a demonstration round. With Sergeant Bothari. None of the fellows here have ever seen that."

Vorkosigan waved down the idea, not very convincingly. "I'm not in shape for it, Lieutenant. Besides, how did they ever find out about that? Been telling tales?"

Koudelka grinned. "A few. I think it would enlighten them. About what kind of game this can really be."

"A bad example, I'm afraid."

"I've never seen this," murmured Cordelia. "Is it really that good a show?"

"I don't know. Have I offended you lately? Would watching Bothari pound me be a catharsis?"

"I think it would be for you," said Cordelia, falling in with his obvious desire to be persuaded. "I think you've missed that sort of thing, in this headquarters life you've been leading lately."

"Yes . . ." He rose, to a bit of clapping, and removed uniform jacket, shoes, rings, and the contents of his pockets, and stepped to the ring to do some stretching and warm-up exercises.

"You'd better referee, Kou," he called back. "Just to prevent undue alarm."

"Yes, sir." Koudelka turned to Cordelia before limping back to the arena. "Um. Just remember, milady. They never killed each other in four years of this."

"Why do I find that more ominous than reassuring? Still, Bothari's done six rounds this morning. Maybe he's getting tired."

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The two men faced off in the arena and bowed formally. Koudelka backed hastily out of the way. The raucous good humor died away among the watchers, as the icy cold and concentrated stillness of the two players drew all eyes. They began to circle, lightly, then met in a blur. Cordelia did not quite see what happened, but when they parted Vorkosigan was spitting blood from a lacerated mouth, and Bothari was hunched over his belly.

In the next contact Bothari landed a kick to Vorkosigan's back that echoed off the garden walls and propelled him completely out of the arena, to land rolling and running back in spite of disrupted breathing. The men in whose protection the Regent's life was supposed to lie began to look worriedly at one another. At the next grappling Vorkosigan underwent a vicious fall, with Bothari landing atop him instantly for a follow-up choke. Cordelia thought she could see his ribs bend from the knees on his chest. A couple of the guards started forward, but Koudelka waved them back, and Vorkosigan, face dark and suffused, tapped out.

"First point to Sergeant Bothari," called Koudelka. "Best two out of three, sir?"

Sergeant Bothari stood, smiling a little, and Vorkosigan sat on the mat a minute, regaining his wind. "One more, anyway. Got to get my revenge. Out of shape."

"Told you so," murmured Bothari.

They circled again. They met, parted, met again, and suddenly Bothari was doing a spectacular cartwheel, while Vorkosigan rolled beneath to grab an arm-bar that nearly dislocated his shoulder in his twisting fall. Bothari struggled briefly against the lock, then tapped out. This time it was Bothari who sat on the mat a minute before getting up.

"That's amazing," Droushnakovi commented, eyes avid. "Especially considering how much smaller he is."

"Small but vicious," agreed Cordelia, fascinated. "Keep that in mind."

The third round was brief. A blur of grappling and blows and a messy joint fall resolved suddenly in an arm lock, with Bothari in charge. Vorkosigan unwisely attempted a break, and Bothari, quite expressionlessly, dislocated his elbow with an audible pop. Vorkosigan yelled and tapped out. Once again Koudelka suppressed a rush of uninvited aid.

"Put it back, Sergeant," Vorkosigan groaned from his seat on the ground, and Bothari braced one foot on his former captain and gave the arm an accurately-aligned yank.

"Must remember," gasped Vorkosigan, "not to do that."

"At least he didn't break it this time," said Koudelka encouragingly, and helped him up, with Bothari's assistance. Vorkosigan limped back to the lawn chair, and seated himself, very cautiously, at Cordelia's feet. Bothari, too, was moving a lot more slowly and stiffly.

"And that," said Vorkosigan, still catching his breath, "is how . . . we used to play the game . . . aboard the old *General Vorkraft*."

"All that effort," remarked Cordelia. "And how often did you ever get into a real hand-to-hand combat situation?"

"Very, very seldom. But when we did, we won."

The party broke up, with a murmur-

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ing undercurrent of comment from the other players. Cordelia accompanied Aral off to give him some first-aid to his elbow and mouth, a hot soak and rubdown, and a change of clothes.

During the rubdown she brought up the personnel problem that she noticed had been growing.

"*Do you suppose you could* say something to Kou about the way he treats Drou? It's not like his usual self at all. She about does flips trying to be nice to him. And he doesn't even treat her with the courtesy he'd give one of his men. She's practically a fellow officer. And, unless I'm totally wide of the mark, madly in love with him. Why doesn't he see it?"

"What makes you think he doesn't?" asked Aral slowly.

"His behavior, of course. A shame. They'd make quite a pair. Don't you think she's attractive?"

"Marvelously. But then, I like tall amazons," he grinned over his shoulder at her, "as everyone knows. It's not every man's taste. But if that's a matchmaking gleam I detect in your eye—do you suppose it could be maternal hormones, by the way?"

"Shall I dislocate your other elbow?"

"Ugh. No thanks. I'd forgotten how painful a workout with Bothari could be. Ah, that's better. Down a bit. . . ." '

"You're going to have some astonishing bruises there tomorrow."

"Don't I know it. But before you get carried away over Drou's love life . . . have you thought carefully about Koudelka's injuries?"

"Oh." Cordelia was struck silent. "I'd assumed . . . that his sexual functions were as well-repaired as the rest of him."

"Or as poorly. It's a very delicate bit of surgery."

Cordelia pursed her lips. "Do you know this for a fact?"

"No, I don't. I do know that in all our conversations the subject was never once brought up. Ever."

"Hm. Wish I knew how to interpret that. It sounds a little ominous. Do you think you could ask . . . ?"

"Good God, Cordelia, of course not! What a question to ask the man. Particularly if the answer is no. I've got to work with him, remember."

"Well, I've got to work with Drou. She's no use to me if she pines away and dies of a broken heart. He has reduced her to tears, more than once. She goes off where she thinks nobody's looking."

"Really? That's hard to imagine."

"You can hardly expect me to tell her he's not worth it, all things considered. But does he really dislike her? Or is it just self-defense?"

"Good question. For what it's worth, my driver made a joke about her the other day, not even a very offensive one, and Kou got rather frosty with him. I don't think he dislikes her. But I do think he envies her."

Cordelia left the subject on that ambiguous note. She longed to help the pair, but had no answer to offer for their dilemma. Her own mind had no trouble generating creative solutions to the practical problems of physical intimacy posed by the lieutenant's injuries, but shrank from the violation of their shy reserve that offering them would entail. She suspected wryly that she would

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merely shock them. Sex therapy appeared to be unheard of here.

True Betan, she had always considered a double standard of sexual behavior to be a logical impossibility. Dabbling now on the fringes of Barrayaran high society in Vorkosigan's wake, she began to finally see how it could be done. It all seemed to come down to impeding the free flow of information to certain persons, preselected by an unspoken code somehow known to and agreed upon by all present but her. One could not mention sex to or in front of unmarried women or children. Young men, it appeared, were exempt from all rules when talking to each other, but not if a woman of any age or degree were present. The rules also changed bewilderingly with variations of the social status of those present. And married women, in groups free of male eavesdroppers, sometimes underwent the most astonishing transformations in apparent data bases. Some subjects could be joked about but not discussed seriously. And some variations could not be mentioned at all. She had blighted more than one conversation beyond hope of recovery by what seemed to her a perfectly obvious and casual remark, and been taken aside by Aral for a quick debriefing.

She tried writing out a list of the rules she thought she had deduced, but found them so illogical and conflicting, especially in the area of what certain people were supposed to pretend not to know in front of certain other people, she gave up the effort. She did show the list to Aral, who read it in bed one night and nearly doubled over laughing.

"Is that what we really look like to you? I like your Rule Seven. Must keep it in mind. . . . I wish I'd known it in my youth. I could have skipped all those godawful Service training vids."

"If you snicker any harder, you're going to get a nosebleed," she said tartly. "These are your rules, not mine. You people play by them. I just try to figure them out."

"My sweet scientist. Hm. You certainly call things by their correct names. We've never tried . . . would you like to violate Rule Eleven with me, dear Captain?"

"Let me, see, which one—oh, yes! Certainly. Now? And while we're about it, let's knock off Thirteen. My hormones are up. I remember my brother's co-parent told me about this effect, but I didn't really believe her at the time. She says you make up for it later, postpartum."

"Thirteen? I'd never have guessed—"

"That's because, being Barrayaran, you spend so much time following Rule Two."

Anthropology was forgotten, for a time. But she found she could crack him up, later, with a properly timed mutter of "Rule Nine, sir."

The season was turning. There had been a hint of winter in the air that morning, a frost that had wilted some of the plants in Count Piotr's back garden. Cordelia anticipated her first real winter with fascination. Vorkosigan promised her snow, frozen water, something she'd experienced on only two Survey missions. *Before spring, I shall bear a son. Huh.*

But the afternoon had basked in the autumn light, warming again. The flat

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roof of Vorkosigan House above the front wing now breathed back that heat around Cordelia's ankles as she picked her way across it, though the air on her cheeks was cooling to crispness as the sun slanted to the city's horizon.

"Good evening, boys," Cordelia nodded to the two guards posted to this rooftop duty station.

They nodded back, the senior touching his forehead in a hesitant semi-salute. "Milady."

Cordelia had taken to regular sunset-watching up here. The view of the cityscape from this four-floors-up vantage was very fine. She could catch a gleam of the river that divided the town, beyond trees and buildings. Although the excavation of a large hole a few blocks away along the line of sight suggested that the riverine scene would be occluded soon by new architecture. The tallest turret of Vorhartung Castle, where she'd attended all those ceremonies in the Council of Counts' chamber, peaked from a bluff overlooking the water.

Beyond Vorhartung Castle lay the oldest parts of the capital. She'd not yet seen that area, its kinked one-horse-wide streets impassable to groundcars, though she'd flown over the strange, low, dark blots in the heart of the city. The newer parts, glittering out toward the horizon, were more like galactic standard, patterned around the modern transportation systems.

None of it was like Beta Colony. Vorbarr Sultana was all spread out on the surface, or climbed skyward, strangely two-dimensional and exposed. Beta Colony's cities plunged down into shafts and tunnels, many-layered and complex, cozy and safe. Indeed, Beta Colony did not have architecture so much as it had interior design. It was amazing, the variety of schemes people came up with to vary dwellings that had identical outsides.

The guards twitched and sighed, as she leaned on the stonework, gazing out. They really didn't like it when she strayed nearer than three meters to the edge, though the space was only six meters wide. But she should be able to spot Vorkosigan's groundcar turning in to the street soon. Sunsets were all very well, but her eyes turned downward.

She inhaled the complex odors, from vegetation, water vapor, industrial waste gases. Barrayar permitted an amazing amount of air dumping, as if . . . well, air *was* free, here. Nobody measured it, there were no air processing and filtration fees . . . did these people even realize how rich they were? All the air they could breathe, just by stepping outdoors, taken for granted as casually as they took frozen water falling from the sky. She took an extra breath, as if she could somehow greedily hoard it, and smiled—

A distant, crackling, hard-edged *boom* shattered her thoughts and stopped her breath. Both guards jumped. *So, you heard a bang. It doesn't necessarily have anything to do with Aral.* And, icily, *It sounded like a sonic grenade. Not a little one.* Dear God. There was a column of smoke and dust rising from a street-canyon several blocks over, she couldn't see the source—she craned outward—

"Milady." The younger guard grasped her upper arm. "Please go inside." His face was tense, eyes wide. The senior man had his hand clamped to his ear,

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sucking info off his comm channel—*she* had no comm link.

"What's coming on?" she asked.

"Milady, please go below!" He hustled her toward the trapdoor to the attic, from which stairs led down to the fourth floor. "I'm sure it was nothing," he soothed as he pushed.

"It was a Class Four sonic grenade, probably air-tube launched," she informed his appalling ignorance. "Unless the thrower was suicidal. Haven't you ever heard one go off?"

Droushnakovi shot out the trapdoor, a buttered roll squashed in one hand and her stunner clutched in the other. "Milady?" The guard, looking relieved, shoved Cordelia at her and returned to his senior. Cordelia, screaming inside, grinned through clenched teeth and allowed herself to be guarded, climbing dutifully down the trap.

"What happened?" she hissed to Droushnakovi.

"Don't know yet. The red alert went off in the basement refectory, and everybody ran for their posts," panted Drou. She must have practically teleported up the six flights.

"*Ngh.*" Cordelia galloped down the stairs, wishing for a drop tube. The comconsole in the library would surely be manned—somebody must have a comm link—she spun down the circular staircase and pelted across the black and white stones.

The house guard commander was indeed at the post, channeling orders. Count Piotr's senior liveried man jittered at his shoulder. "They're coming straight here," the ImpSec man said over his shoulder. "You fetch that doctor." The brown-uniformed man dashed out.

"What happened?" Cordelia demanded. Her heart was hammering, now, and not just from the dash downstairs.

He glanced up at her, started to say something calming and meaningless, and changed his mind in mid-breath. "Somebody took a pot-shot at the Regent's groundcar. They missed. They're continuing on here."

"How near a miss?"

"I don't know, milady."

He probably didn't. But if the ground car still functioned. . . . Helplessly, she gestured him back to his work, and wheeled to return to the foyer, now manned by a couple of Count Piotr's men, who discouraged her from standing too near the door. She hung on the stair railing three steps up and bit her lip.

"Was Lieutenant Koudelka with him, do you think?" asked Droushnakovi faintly.

"Probably. He usually is," Cordelia answered absently, her eyes on the door, waiting, waiting. . . .

She heard the car pull up. One of Count Piotr's men opened the house door. Security men swarmed over the silver shape of the vehicle in the portico—God, where did they all *come* from? The car's shiny finish was scored and smoked, but not deeply dented; the rear canopy was not cracked, though the front was starred. The rear doors swung up, and Cordelia stretched for a view of Vorkosigan, maddeningly obstructed by the green backs of the ImpSec men. They parted. Lieutenant Koudelka sat in the aperture, blinking dizzily, blood

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dripping down his chin, then was levered to his feet by a guard. Vorkosigan emerged at last, refusing to be hustled, waving back help. Even the most worried guards did not dare touch him without an invitation. Vorkosigan strode inside, grim-faced and pale. Koudelka, propped by his stick and an ImpSec corporal, followed, looking wilder. The blood issued from his nose. Piotr's man swung closed the front door of Vorkosigan House, shutting out three-fourths of the chaos.

Aral met her eyes, above the heads of the men, and the saturnine look fixed on his face slipped just a little. He offered her a fractional nod, *I'm all right.* Her lips tightened in return, *You'd by-God better be. . . .*

Kou was saying in a shaken voice, "—bloody great hole in the street! Could've swallowed a freight shuttle. That driver has amazing reflexes —what?" He shook his head at a questioner. "Sorry, my ears are ringing —come again?" He stood open mouthed, as if he could drink in sound orally, touched his face and stared in surprise at his crimson-smeared hand.

"Your ears are only stunned, Kou," said Vorkosigan. His voice was calm, but much too loud. "They'll be back to normal by tomorrow morning." Only Cordelia realized the raised tone wasn't for Koudelka's benefit—Vorkosigan couldn't hear himself, either. His eyes shifted too quickly, the only hint that he was trying to read lips.

Simon Illyan and a physician arrived at almost the same moment. Vorkosigan and Koudelka were taken to a quiet back parlor, shedding all the—to Cordelia's mind—rather useless guards. Cordelia and Droushnakovi followed. The physician began an immediate examination, starting, at Vorkosigan's command, with the gory Koudelka.

"One shot?" asked Illyan.

"Only one," confirmed Vorkosigan, watching his face. "If they'd lingered for a second try, they could have bracketed me."

"If he'd lingered, we could have bracketed *him.* A forensic team's on the firing site now. The assassin's long gone, of course. A clever spot, he had a dozen escape routes."

"We vary our route daily," Lieutenant Koudelka, following this with difficulty, said around the cloth he pressed to his face. "How did he know where to set up his ambush?"

"Inside information?" Illyan shrugged, his teeth clenching at the thought.

"Not necessarily," said Vorkosigan. "There are only so many routes, this close to home. He could have been set up waiting for days."

"Precisely at the limit of our close-search perimeter?" said Illyan. "I don't like it."

"It bothers me more that he missed," said Vorkosigan. "Why? Could it have been some sort of warning shot? An attempt, not on my life, but on my balance of mind?"

"It was old ordnance," said Illyan. "There could have been something wrong with its tracker—nobody detected a laser rangefinger pulse." He paused, taking in Cordelia's white face. "I'm sure it was a lone lunatic, milady. At least, it was certainly only one man."

"How does a lone maniac get hold

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of military-grade weaponry?'' she inquired tartly.

Illyan looked uncomfortable. ''We will be investigating that. It was definitely old issue.''

''Don't you destroy obsolete stockpiles?''

''There's so much of it. . . .''

Cordelia glared at this wit-scattered utterance. ''He only needed one shot. If he'd managed a direct hit on that sealed car, Aral'd have been emulsified. Your forensic team would be trying right now to sort out which molecules were his and which were Kou's.''

Droushnakovi turned faintly green; Vorkosigan's saturnine look was now firmly back in place.

''You want me to give you a precise resonance reflection amplitude calculation for that sealed passenger cabin, Simon?'' Cordelia went on hotly. ''Whoever chose that weapon was a competent military tech—if, fortunately, a poorish shot.'' She bit back further words, recognizing, even if no one else did, the suppressed hysteria driving the speed of her speech.

''My apologies, Captain Naismith.'' Illyan's tone grew more clipped. ''You are quite correct.'' His nod was a shade more respectful.

Aral tracked this interplay, his face lightening, for the first time, with some hidden amusement.

Illyan took himself off, conspiracy theories no doubt dancing in his head. The doctor confirmed Aral's combat-experienced diagnosis of aural stun, issued powerful anti-headache pills—Aral hung onto his firmly—and made an appointment to recheck both men in the morning.

* * *

When Illyan stopped back by Vorkosigan House in the late evening to confer with his guard commander, it was all Cordelia could do not to grab him by the jacket and pin him to the nearest wall to shake out his information. She confined herself to simply asking. ''Who tried to kill Aral? Who *wants* to kill Aral? Whatever benefit do they imagine they'll gain?''

Illyan sighed. ''Do you want the short list, or the long one, milady?''

''How long is the short list?'' she asked in morbid fascination.

''Too long. But I can name you the top layer, if you like.'' He counted them off on his fingers. ''The Cetagandans, always. They had counted on political chaos here, following Ezar's death. They're not above prodding it along. An assassination is cheap interference, compared to an invasion fleet. The Komarrans, for old revenge or new revolt. Some there still call the Admiral the Butcher of Komarr—''

Cordelia, knowing the whole story behind that loathed sobriquet, winced.

''The anti-Vor, because my lord Regent is too conservative for their tastes. The military right, who fear he is too progressive for theirs. Leftover members of Prince Serg and Vorrutyer's old war party. Former operatives of the now-suppressed Ministry of Political Education, though I doubt one of them would have missed. Negri's department used to train them. Some disgruntled Vor who thinks he came out short in the recent power-shift. Any lunatic with access to weapons and a desire for instant fame as a big-game hunter—shall I go on?''

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"Please don't. But what about today? If motive yields too broad a field of suspects, what about method and opportunity?"

"We have a little to work with there, though too much of it is negative. As I noted, it was a very clean attempt. Whoever set it up had to have access to certain kinds of knowledge. We'll work those angles first."

It was the anonymity of the assassination attempt that bothered her most, Cordelia decided. When the killer could be anyone, the impulse to suspect everyone became overwhelming. Paranoia was a contagious disease here, it seemed, Barrayarans gave it to each other. Well, Negri and Illyan's combined forces must winkle out some concrete facts soon. She packed all her fears down hard into a little tiny compartment in the pit of her stomach, and locked them there. Next to her child.

Vorkosigan held her tight that night, curled into the curve of his stocky body, though he made no sexual advances. He just held her. He didn't fall asleep for hours, despite the pain killers that glazed his eyes. She didn't fall asleep till he had. His snores lulled her at last. There wasn't that much to say. *They missed; we go on.*

Till the next try.

CHAPTER FIVE

The Emperor's Birthday was a traditional Barrayaran holiday, celebrated with feasting, dancing, drinking, veterans' parades, and an incredible amount of apparently totally unregulated fireworks. It would make a great day for a surprise attack on the capital, Cordelia decided; an artillery barrage could be well underway before anybody noticed it in the general din. The uproar began at dawn.

The duty guards, who had a natural tendency to jump at sudden noises anyway, were twitchy and miserable, except for a couple more youthful types who attempted to celebrate with a few crackers let off inside the walls. They were taken aside by the guard commander, and emerged much later, pale and shrunken, to slink off. Cordelia later saw them hauling rubbish under the command of a sardonic housemaid, while a scullery girl and the second cook galloped happily out of the house for a surprise day off. The Emperor's Birthday was a moveable feast. The Barrayarans's enthusiasm for the holiday seemed undaunted by the fact that, due to Ezar's death and Gregor's ascension, this was the second time they would celebrate it this year.

Cordelia passed up an invitation to attend a major military review that gobbled up Aral's morning in favor of staying fresh for the event of the evening—the event of the year, she was given to understand—personal attendance upon the emperor's birthday dinner at the Imperial Residence. She looked forward to seeing Kareen and Gregor again, however briefly. At least she was certain that her clothing was all right. Lady Vorpatril, who had both excellent taste and an advance line on Barrayaran-style maternity wear, had taken pity on Cordelia's cultural bafflement and offered herself as an expert native guide.

As a result, Cordelia confidently wore an impeccably-cut forest green silk dress that swirled from shoulder to floor with an open over-vest of thick ivory

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velvet. Live flowers in matching colors were arranged in her copper hair by the live human hairdresser Alys also sent on. Like their public events, the Barrayarans made of their clothes a sort of folk-art, as elaborate as Betan body paint. Cordelia couldn't be sure from Aral—his face always lit when he saw her—but judging from the delighted "Oohs" of Count Piotr's female staff, Cordelia's sartorial art team had outdone themselves.

Waiting at the foot of the spiral stairs in the front hall, she smoothed the panel of green silk surreptitiously down over her belly. A little over three months of metabolic overdrive, and all she had to show for it was this grapefruit-sized lump—so much had happened since mid-summer, it seemed like her pregnancy ought to be progressing faster to keep up. She purred an encouraging mental mantra belly-wards, *Grow, grow, grow. . . .* At least she was actually beginning to look pregnant, instead of just feeling exhausted. Aral shared her nightly fascination with their progress, gently feeling with spread fingers, so far without success, for the butterfly-wing flutters of movement through her skin.

Aral himself now appeared, with Lieutenant Koudelka. They were both thoroughly scrubbed, shaved, cut, combed, and chromatically blinding in their formal red and blue Imperial parade uniforms. Count Piotr joined them wearing the uniform Cordelia had seen him in at the Joint Council sessions, brown and silver, a more glittery version of his armsmen's livery. All twenty of Piotr's armsmen had some sort of formal function tonight, and had been driven to meticulous preparation all week by their frenzied commander. Droushnakovi, accompanying Cordelia, wore a simplified garment in Cordelia's colors, carefully cut to facilitate rapid movement and conceal weaponry and comm links.

After a moment for everyone to admire each other, they herded through the front doors to the waiting groundcars. Aral handed Cordelia into her vehicle personally, then stepped back. "See you there, love."

"What?" Her head swiveled. "Oh. Then that second car . . . isn't just for the size of the group?"

Aral's mouth tightened fractionally. "No. It seems . . . prudent, to me, that we should travel in separate vehicles from now on."

"Yes," she said faintly. "Quite."

He nodded, and turned away. *Damn* this place. Taking yet another bite out of their lives, out of her heart. They had so little time together anymore, even a little more lost hurt.

Count Piotr, apparently, was to be Aral's stand-in, at least for tonight; he slid in beside her. Droushnakovi sat across from them, and the canopy was sealed. The car turned smoothly into the street. Cordelia craned over her shoulder, trying to see Aral's car, but it followed too far back for her even to catch a glimpse. She straightened, sighing.

The sun was sinking yellowly in a grey bank of clouds, and lights were beginning to glow in the cool damp autumn evening, giving the city a somber, melancholy atmosphere. Maybe a raucous street party—they drove around several—wasn't such a bad idea. The celebrators reminded Cordelia of prim-

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itive Earth men banging pots and firing guns to drive off the dragon that was eating the eclipsing moon. This strange autumn sadness could consume an unwary soul. Gregor's birthday was well-timed.

Piotr's knobby hands fiddled with a brown silk bag embroidered with the Vorkosigan crest in silver. Cordelia eyed it with interest. "What's that?"

Piotr smiled slightly, and handed it to her. "Gold coins."

More folk-art; the bag and its contents were a tactile treat. She caressed the silk, admired the needlework, and shook a few gleaming sculptured disks out into her hand. "Pretty." Prior to the end of the Time of Isolation, gold had had great value on Barrayar, Cordelia recalled reading. *Gold* to her Betan mind called up something like, *Sometimes-useful metal to the electronics industry*, but ancient peoples had waxed mystical about it. "Does this mean something?"

"Ha! Indeed. It's the emperor's birthday present."

Cordelia pictured five-year-old Gregor playing with a bag of gold. Besides building towers and maybe practicing counting, it was hard to figure what the boy could do with it. She hoped he was past the age of putting everything in his mouth, those disks were just the right size for a child to swallow or choke on. "I'm sure he'll like it," she said a little doubtfully.

Piotr chuckled. "You don't know what's going on, do you?"

Cordelia sighed. "I almost never do. Cue me." She settled back, smiling. Piotr had gradually become an enthusiast in explaining Barrayar to her, always seeming pleased to discover some new pocket of her ignorance and fill it with information and opinion. She had the feeling he could be lecturing her for the next twenty years and not run out of baffling topics.

"The Emperor's Birthday is the traditional end of the fiscal year, for each count's district in relation to the Imperial government. In other words, it's tax day, except—the Vor are not taxed. That would imply too subordinate a relationship to the Imperium. Instead, we give the emperor a present."

"Ah . . ." said Cordelia. "You don't run this place for a year on sixty little bags of gold, sir."

"Of course not. The real funds went from Hassadar to Vorbarr Sultana by comm link transfer earlier today. The gold is merely symbolic."

Cordelia frowned. "Wait. Haven't you done this once this year?"

"In the spring for Ezar, yes. So we've just changed the date of our fiscal year."

"Isn't that disruptive to your banking system?"

He shrugged. "We manage." He grinned suddenly. "Where do you think the term 'Count' came from, anyway?"

"Earth, I thought. A pre-atomic—late Roman, actually—term for a nobleman who ran a county. Or maybe the district was named after the rank."

"On Barrayar, it is in fact a contraction of the term "accountant." The first 'counts were Varadar Tau's—an amazing bandit, you should read up on him sometime—Varadar Tau's tax collectors."

"All this time I thought it was a military rank! Aping medieval history."

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"Oh, the military part came immediately thereafter, the first time the old goons tried to shake down somebody who didn't want to contribute. The rank acquired more glamour later."

"I never knew." She regarded him with sudden suspicion. "You're not pulling my leg, sir, are you?"

He spread his hands in denial.

Check your assumptions, Cordelia thought to herself in amusement. *In fact, check your assumptions at the door.*

They arrived at the Imperial Residence's great gate. The ambience was much changed tonight from some of Cordelia's earlier, more morbid visits to the dying Ezar and to the funeral ceremonies. Colored lights picked out architectural details on the stone pile. The gardens glowed, fountains glittered. Beautifully dressed people warmed the landscape, spilling out from the formal rooms of the north wing onto the terraces. The guard checks, however, were no less meticulous, and the guards' numbers were vastly multiplied. Cordelia had the feeling this was going to be a much less rowdy party than some they'd passed in the city streets.

Aral's car pulled up behind theirs as they disembarked at a western portico, and Cordelia reattached herself gratefully to his arm. He smiled proudly at her, and in a relatively unobserved moment sneaked a kiss on to the back of her neck while stealing a whiff of the flowers perfuming her hair. She squeezed his hand secretly in return. They passed through the doors and a corridor. A majordomo in Vorbarra house livery loudly announced them, and then they were pinned by the gaze of what to Cordelia, for a moment, seemed to be several thousand pairs of critical Barrayaran Vor-class eyes. Actually there were only a couple hundred people in the room. Better than, say, looking down the throat of a fully-charged nerve disruptor any day. Really.

They circulated, exchanging greetings, making courtesies. *Why can't these people wear name tags?* Cordelia thought hopelessly. As usual, everyone but her seemed to know everyone else. She pictured herself opening a conversation. *Hey you, Vor-guy—.* She clutched Aral more firmly, and tried to look mysterious and exotic rather than tongue-tied and mislaid.

They found the little ceremony with the bags of coins going on in another chamber, the counts or their representatives lining up to discharge their obligation with a few formal words each. Emperor Gregor, whom Cordelia suspected was up past his bedtime, sat on a raised bench with his mother, looking small and trapped, manfully trying to suppress his yawns. It occurred to Cordelia to wonder if he even got to keep the bags of coins, or if they were simply recirculated to present again next year. Hell of a birthday party. There wasn't another child in sight. But they were running the counts through pretty efficiently, maybe the kid could escape soon.

An offerer in red-and-blues knelt before Gregor and Kareen, and presented his bag of maroon and gold silk. Cordelia recognized Count Vidal Vordarian, the dish-faced man whom Aral had politely described as of the "next-most-conservative party," i.e., of roughly the same political views as Count Piotr, in a tone of voice that had made Cordelia

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wonder if it was a code-phrase for "Isolationist fanatic." He did not look a fanatic. Freed of its distorting anger, his face was much more attractive; he turned it now to Princess Kareen, and said something which made her lift her chin and laugh. His hand rested familiarly for a moment upon her robed knee, and her hand covered his briefly, before he clambered back to his feet and bowed, and made way for the next man. Kareen's smile faded as Vordarian turned his back.

Gregor's sad glance crossed Aral, Cordelia, and Droushnakovi; he spoke earnestly up to his mother. Kareen motioned a guard over, and a few minutes later a guard commander approached them, for permission to carry off Drou. She was replaced by an unobtrusive young man who trailed them out of earshot, a mere flicker at the corner of the eye, a neat trick for a fellow that large.

Happily, Cordelia and Aral soon ran across Lord and Lady Vorpatril, someone Cordelia dared talk to without a politico-social pre-briefing. Captain Lord Vorpatril's parade red-and-blues set off his dark-haired good looks to perfection. Lady Vorpatril barely outshone him in a carnelian dress with matching roses woven into her cloud of black hair, stunning against her velvety white skin. They made, Cordelia thought, an archetypal Vor couple, sophisticated and serene, the effect only slightly spoiled by the gradual awareness from his disjointed conversation that Captain Vorpatril was drunk. He was a cheerful drunk, though, his personality merely stretched a bit, not unpleasantly transformed.

Vorkosigan, drawn away by some men who bore down on him with Purpose in their eyes, handed Cordelia off to Lady Vorpatril. The two women cruised the elegant hors d'ouvre trays being offered around by yet more human servants, and compared obstetrical reports. Lord Vorpatril hastily excused himself to pursue a tray bearing wine. Alys plotted the colors and cut of Cordelia's next gown. "Black and white, for you, for Winterfair," she asserted with authority. Cordelia nodded meekly, wondering if they were actually going to sit down for a meal soon, or if they were expected to keep grazing off the passing trays.

Alys guided her to the ladies' lavatory, an object of hourly interest to their pregnancy-crowded bladders, and introduced her on the return journey to several more women of her rarified social circle. Alys then fell into an animated discussion with a long-standing crony regarding an upcoming party for the woman's daughter, and Cordelia drifted to the edge of the group.

She stepped back quietly, separating herself (she tried not to think, *from the herd*) for a moment of quiet contemplation. What a strange mix Barrayar was, at one moment homey and familiar, in the next terrifying and alien . . . they put on a good show, though . . . ah! That's what was missing from the scene, Cordelia realized. On Beta Colony a ceremony of this magnitude would be fully covered by holovid, to be shared real-time planet-wide. Every move would be a carefully choreographed dance around the vid angles and commentators' timing, almost to the point of annihilating the event being recorded. Here, there wasn't a holovid in sight.

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The only recordings were made by ImpSec, for their own purposes, which did not include choreography. The people in this room danced only for each other, all their glittering show tossed blithely away in time, which carried it off forever; the event would exist tomorrow only in their memories.

"Lady Vorkosigan?"

Cordelia started from her meditations at the urbane voice at her elbow. She turned to find Commodore Count Vordarian. His wearing of red-and-blues, rather than his personal House livery colors, marked him as being on active service, ornamenting Imperial Headquarters no doubt—in what department? Yes, Ops, Aral had said. He had a drink in his hand, and smiled cordially.

"Count Vordarian," she offered in return, smiling too. They'd seen each other in passing often enough, Cordelia decided to take him as introduced. This Regency business wasn't going to go away, however much she might wish it to; it was time and past time for her to start making connections of her own, and quit pestering Aral for guidance at every new step.

"Are you enjoying the party?" he inquired.

"Oh, yes." She tried to think of something more to say. "It's extremely beautiful."

"As are you, milady." He raised his glass to her in a gesture of toast, and sipped.

Her heart lurched, but she identified the reason why before her eyes did more than widen slightly. The last Barrayaran officer to toast her had been the late Admiral Vorrutyer, under rather different social circumstances. Vordarian had accidently mimicked his precise gesture. This was no time for torture-flashbacks. Cordelia blinked. "Lady Vorpatril helped me a lot. She's very generous."

Vordarian nodded delicately toward her torso. "I understand you also are to be congratulated. Is it a boy or a girl?"

"Uh? Oh. Yes, a boy, thank you. He's to be named Piotr Miles, I'm told."

"I'm surprised. I should have thought the Lord Regent would have sought a daughter first."

Cordelia cocked her head, puzzled by his ironic tone. "We started this before Aral became Regent."

"But you knew he was to receive the appointment, surely."

"I didn't. But I thought all you Barrayaran militarists were mad after sons. Why did you think a daughter?" *I want a daughter. . . .*

"I assumed Lord Vorkosigan would be thinking ahead to his long-term, ah, employment, of course. What better way to maintain this continuity of his power after the Regency is over than to slip neatly into position as the emperor's father-in-law?"

Cordelia boggled. "You think he'd bet the continuity of a planetary government on the chance of a couple of teenagers falling in love, a decade and a half from now?"

"Love?" Now he looked baffled.

"You Barrayarans are—" she bit her tongue on the *crazy*. Impolite. "Aral is certainly more . . . practical." Though she could hardly call him unromantic.

"That's extremely interesting," he breathed. His eyes flicked to and away

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from her abdomen. "Do you fancy he contemplates something more direct?"

Her mind was running tangential to this twisting conversation, somehow. "Beg pardon?"

He smiled and shrugged.

Cordelia frowned. "Do you mean to say, if we were having a girl, that's what everyone would be thinking?"

"Certainly."

She blew out her breath. "God. That's . . . I can't imagine anyone in their right mind wanting to get near the Barrayaran Imperium. It just makes you a target for every maniac with a grievance, as far as I can see." An image of Lieutenant Koudelka, bloody-faced and deafened, flashed in her mind. "Also hard on the poor fellow who's unlucky enough to be standing next to you."

His attention sharpened. "Ah, yes, that unfortunate incident the other day. Has anything come of the investigation, do you know?"

"Nothing that I've heard. Negri and Illyan are talking Cetagandans, mostly. But the guy who launched the grenade got away clean."

"Too bad." He drained his glass, and exchanged it for a freshly-charged one presented immediately by a passing Vorbarra-liveried servant. Cordelia eyed the wine glasses wistfully. But she was off metabolic poisons for the duration. Yet another advantage of Betan-style gestation in uterine replicators, none of this blasted enforced clean living. At home she could have poisoned and endangered herself freely, while her child grew, fully monitored round-the-clock by sober techs, safe and protected in the replicator banks. Suppose she had been under that sonic grenade . . . she longed for a drink.

Well, she did not need the mind-numbing buzz of ethanol, conversation with Barrayarans was mind-numbing enough. Her eyes sought Aral in the crowd—there he was, Kou at his shoulder, talking with Piotr and two other grizzled old men in counts' liveries. As Aral had predicted, his hearing had returned to normal within a couple of days. Yet still his eyes shifted from face to face, drinking in cues of gestures and inflection, his glass a mere untasted ornament in his hand. On duty, no question. Was he ever off-duty, anymore?

"Was he much disturbed by the attack?" Vordarian inquired, following her gaze to Aral.

"Wouldn't you be?" said Cordelia. "I don't know . . . he's seen so much violence in his life, almost more than I can imagine. It may be almost like . . . white noise. Tuned out." *I wish I could tune it out.*

"You have not known him that long, though. Just since Escobar."

"We met once before the war. Briefly."

"Oh?" His brows rose. "I didn't know that. How little one truly knows of people." He paused, watching Aral, watching her watch Aral. One corner of his mouth crooked up, then the quirk vanished in a thoughtful pursing of his lips. "He's bisexual, you know." He took a delicate sip of his wine.

"Was bisexual," she corrected absently, looking fondly across the room. "Now he's monogamous."

Vordarian choked, sputtering. Cordelia watched him with concern, wondering if she ought to pat him on the

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back or something, but he regained his breath and balance. "He *told* you that?" he wheezed in astonishment.

"No, Vorrutyer did. Just before he meet his, um, fatal accident." Vordarian was standing frozen; she felt a certain malicious glee at having at last baffled a Barrayaran as much as they sometimes baffled her. Now, if she could just figure out what she'd said that had thrown him. . . . She went on seriously, "The more I look back on Vorrutyer, the more he seems a tragic figure. Still obsessed with a love affair that was over eighteen years ago. Yet I sometimes wonder, if he could have had what he wanted then—kept Aral—if Aral might have kept that sadistic streak that ultimately consumed Vorrutyer's sanity under control. It's as if the two of them were on some kind of weird see-saw, each one's survival entailing the other's destruction."

"A Betan." His stunned look was gradually fading to one Cordelia mentally dubbed as Awful Realization. "I should have guessed. You are, after all, the people who bioengineered hermaphrodites. . . ." He paused. "How long did you know Vorrutyer?"

"About twenty minutes. But it was a very *intense* twenty minutes." She decided to let him wonder what the hell *that* meant.

"Their, ah, affair, as you call it, was a great secret scandal, at the time."

She wrinkled her nose. "Great secret scandal? Isn't that an oxymoron? Like 'military intelligence,' or 'friendly fire.' Also typical Barrayaranisms, now that I think on it."

Vordarian had the strangest look on his face. He looked, she realized, exactly like a man who had thrown a bomb, had it go *fizz* instead of *BOOM!*, and was now trying to decide whether to stick his hand in and tap the firing mechanism to test it.

Then it was her turn for Awful Realization. *This man just tried to blow up my marriage.* No—*Aral's* marriage. She fixed a bright, sunny, innocent smile on her face, her brain kicking—at last!—into overdrive. Vordarian couldn't be of Vorrutyer's old war party, their leaders had all met with their fatal accidents before Ezar had bowed out, and the rest were scattered and lying low. What did he want? She fiddled with a flower from her hair, and considered simpering. "I didn't imagine I was marrying a forty-four-year-old virgin, Count Vordarian."

"So it seems." He knocked back another gulp of wine. "You galactics are all degenerate. What perversions does he tolerate in return, I wonder?" His eyes glinted in sudden open malice. "Do you know how Lord Vorkosigan's first wife died?"

"Suicide. Plasma arc to the head," she replied promptly.

"It was rumored he'd murdered her. For adultery. Betans, beware." His smile had turned wholly acid.

"Yes, I knew that, too. In this case, an untrue rumor." All pretence of cordiality had evaporated from their exchange. Cordelia had a bad sense of all control escaping with it. She leaned forward, and lowered her voice. "Do you know why Vorrutyer died?"

He couldn't help it, he tilted toward her, drawn in. "No. . . ."

"He tried to hurt Aral through me. I found that . . . annoying. I wish you

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would cease trying to annoy me, Count Vordarian, I'm afraid you might succeed." Her voice fell further, almost to a whisper. "You should fear it too."

His initial patronizing tone had certainly given way to wariness. He made a smooth, open-handed gesture that seemed to symbolize a bow of farewell, and backed away. "Milady." The glance over his shoulder, as he moved off, was thoroughly spooked.

She frowned after him. *Whew.* What an *odd* exchange. What had the man expected, dropping that obsolete datum on her as if it was some shocking surprise? Did Vordarian actually imagine she would go off and tax her husband with his poor taste in companions two decades ago? Would a naive young Barrayaran bride have gone into hysterics? Not Lady Vorpatril, whose social enthusiasms concealed an acid judgment; not Princess Kareen, whose naivete had surely been burned out long ago by that expert sadist Serg. *He fired, but he missed.*

And, more coldly, *Has he fired and missed once before?* That had not been a normal social interaction, not even by Barrayaran standards of one-upmanship. *Or maybe he was just drunk.* She suddenly wanted to talk to Illyan. She closed her eyes, trying to clear her fogged head.

"Are you well, love?" Aral's concerned voice murmured in her ear. "Do you need your nausea medication?"

Her eyes flew open. There he was, safe and sound beside her. "Oh, I'm fine." She attached herself to his arm, lightly, not a panicked limpetlike clamp. "Just thinking."

"They're seating us for dinner."

"Good. It will be nice to sit down, my feet are swelling."

He looked like he wanted to pick her up and carry her, but they paraded in normally, joining the other formal pairs. They sat at a raised table set a little apart from the others, with Gregor, Kareen, Piotr, the Lord Guardian of the Speaker's Circle and his wife, and Prime Minister Vortala. At Gregor's insistence, Droushnakovi was seated with them; the boy seemed painfully glad to see his old bodyguard. *Did I take away your playmate, child?* Cordelia wondered apologetically. It seemed so; Gregor engaged in a negotiation with Kareen for Drou's weekly return "for judo lessons." Drou, used to the Residence atmosphere, was not so overawed as Koudelka, who was stiff with exaggerated care against betrayal by his own clumsiness.

Cordelia found herself seated between Vortala and the Speaker, and carried on conversations with reasonable ease; Vortala was charming, in his blunt way. Cordelia managed nibbles of all the elegantly-served food except a slice off the carcass of a roast bovine, carried in whole. Usually she was able to put out of her mind the fact that Barrayaran protein was not grown in vats, but taken from the bodies of real dead animals. She'd known about their primitive culinary practices before she'd chosen to come here, after all, and had tasted animal muscle before on Survey missions, in the interests of science, survival, or potential new product development for the homeworld. The Barrayarans applauded the fruit- and flower-decked beast, seeming to actually find it attractive and not horrific, and the cook, who'd followed it anxiously out, took

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a bow. The primitive olfactory circuits of her brain had to agree, it smelled great. Vorkosigan had his portion bloody-rare. Cordelia sipped water.

After dessert, and some brief formal toasts offered by Vortala and Vorkosigan, the boy Gregor was at last taken off to bed by his mother. Kareen motioned Cordelia and Droushnakovi to join her. The tension eased in Cordelia's shoulders as they left the big public assembly and climbed to the emperor's quiet, private quarters.

Gregor was peeled out of his little uniform and dove into pajamas, becoming boy and not icon once again. Drou supervised his teeth-brushing, and was inveigled into "just one round" of some game they'd used to play with a board and pieces, as a bedtime treat. This Kareen indulgently permitted, and after a kiss for and from her son, she and Cordelia withdrew to a softly-lit sitting room nearby. A night breeze from the open windows cooled the upper chamber. Both women sat with a sigh, unwinding; Cordelia kicked off her shoes immediately after Kareen did so. Distance-muffled voices, and laughter, drifted through the windows from the gardens below.

"How long does this party go on?" Cordelia asked.

"Dawn, for those with more endurance than myself. I shall retire at midnight, after which the serious drinkers will take over."

"Some of them looked pretty serious already."

"Unfortunately." Kareen smiled. "You will be able to see the Vor class at both its best and its worst, before the night is over."

"I can imagine. I'm surprised you don't import less lethal mood-altering drugs."

Kareen's smile sharpened. "But drunken brawls are *traditional*." She allowed the cutting edge of her voice to soften. "In fact, such things are coming in, at least in the shuttleport cities. As usual, we seem to be adding to rather than replacing our own customs."

"Perhaps that's the best way." Cordelia frowned. How best to probe delicately. . . ? "Is Count Vidal Vordarian one of those in the habit of getting publicly potted?"

"No." Kareen glanced up, narrowing her eyes. "Why do you ask?"

"I had a peculiar conversation with him. I thought an overdose of ethanol might account for it." She remembered Vordarian's hand resting lightly upon the Princess's knee, just short of an intimate caress. "Do you know him well? How would you estimate him?"

Kareen said judiciously, "He's rich . . . proud . . . he was loyal to Ezar during Serg's late machinations against his father. Loyal to the Imperium, to the Vor class. There are four major manufacturing cities in Vordarian's district, plus military bases, supply depots, the biggest military shuttleport. . . . Vidal's is certainly the most economically important area on Barrayar today. The war barely touched the Vordarians's District, it's one of the few the Cetagandans pulled out of by treaty. We sited our first space bases there because we took over facilities the Cetagandans had built and abandoned, and a good deal of economic development followed from that."

"That's . . . interesting," said Cor-

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delia, "but I was wondering about the man personally. His, ah, likes and dislikes, for example. Do you like him?"

"At one time," said Kareen slowly, "I wondered if Vidal might be powerful enough to protect me from Serg. After Ezar died. As Ezar grew more ill, I was thinking, I had better look to my own defense. Nothing appeared to be happening, and no one told me anything."

"If Serg had become emperor, how could a mere count have protected you?" asked Cordelia.

"He would have had to become . . . more. Vidal had ambition, if it were properly encouraged—and patriotism, God knows if Serg had lived he might have destroyed Barrayar—Vidal might have saved us all. But Ezar promised I'd have nothing to fear, and Ezar delivered. Serg died before Ezar and . . . and I have been trying to let things cool, with Vidal, since."

Cordelia abstractedly rubbed her lower lip. "Oh. But do you, personally—I mean, do you like him? Would becoming Countess Vordarian be a nice retirement from the dowager-princess business, someday?"

"Oh! Not now. The emperor's stepfather would be too powerful a man, to set up opposite the Regent. A dangerous polarity, if they were not allied or exactly balanced. Or were not combined in one person."

"Like being the emperor's father-in-law?"

"Yes, exactly."

"I'm having trouble understanding this . . . venereal transmission of power. Do you have some claim to the Imperium in your own right, or not?"

"That would be for the military to decide," she shrugged. Her voice lowered. "It is like a disease, isn't it? I'm too close, I'm touched, infected. . . . Gregor is my hope of survival. And my prison."

"Don't you want a life of your own?"

"No. I just want to live."

Cordelia sat back, disturbed. *Did Serg teach you not to give offense?* "Does Vordarian see it that way? I mean, power isn't the only thing you have to offer. I think you underestimate your personal attractiveness."

"On Barrayar . . . power is the only thing." Her expression grew distant. "I admit . . . I did once ask Captain Negri to get me a report on Vidal. He uses his courtesans normally."

This wistful approval was not exactly Cordelia's idea of a declaration of boundless love. Yet that hadn't been just desire for power she'd seen in Vordarian's eyes at the ceremony, she would swear. Had Aral's appointment as Regent accidently messed up the man's courtship? Might that very well account for the sex-tinged animosity in his speech to her. . . ?

Droushnakovi returned on tiptoe. "He fell asleep," she whispered fondly. Kareen nodded, and tilted her head back in an unguarded moment of rest, until a Vorbarra-liveried messenger arrived and addressed her: "Will you open the dancing with my lord Regent, milady? They're waiting."

"Last duty for the night," Kareen assured Cordelia, as they both shoved their shoes back on. Cordelia's footgear seemed to have shrunk two sizes since the start of the evening. She hobbled after Kareen, Drou trailing.

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A large downstairs room was floored in multi-toned wood marquetry in patterns of flowers, vines, and animals. The polished surface would have been put on a museum wall on Beta Colony; these incredible people danced across it. A live orchestra—selected by cut-throat competition from the Imperial Service Band, Cordelia was informed—provided music, in the Barrayran style. Even the waltzes sounded faintly like marches. Aral and the princess were presented to each other, and he led her off for a couple of good-natured turns around the room, a formal dance that involved each mirroring the other's steps and slides, hands raised but never quite touching. Cordelia was fascinated. She'd never guessed that Aral could dance. This seemed to complete the social requirements, and other couples filtered out on to the floor. Aral returned to her side, looking stimulated. "Dance, milady?"

After that dinner, more like a nap. How did he keep up that alarming hyperactivity? Secret terror, probably. She shook her head, smiling. "I don't know how."

"Ah." They strolled, instead. "I could show you how," he offered as they exited the room onto a bank of terraces that wound off into the gardens, pleasantly cool and dark but for a few colored lights to prevent stumbles on the pathways.

"Mm," she said doubtfully. "If you can find a private spot." If they could find a private spot, she could think of better things to do than dance, though.

"Well, here we—shh," his scimitar grin winked in the dark, and his grip tightened warningly on her hand. They both stood still, at the entrance to a little open space screened by yews and some pink feathery non-Earth plant from eyes above. The music floated clearly down.

"Try, Kou," urged Droushnakovi's voice. Drou and Kou stood facing each other on the far side of the terrace-nook. Doubtfully, Koudelka set his stick down on the stone balustrade, and held up his hands to hers. They began to step, slide, and dip, Drou counting earnestly, "*One*-two-three, *one*-two-three. . . ."

Koudelka tripped, and she caught him; his grip found her waist. "It's no damned good, Drou." He shook his head in frustration.

"Sh . . ." her hand touched his lips. "Try again. I'm for it. You said you had to practice that hand-coordination thing, how long, before you got it? More than once, I bet."

"The old man wouldn't let me give up."

"Well, maybe I won't let you give up either."

"I'm tired," complained Koudelka.

So, switch to kissing. Cordelia urged silently, muffling a laugh. *That you can do sitting down.* Droushnakovi was determined, however, and they began again, "*One*-two-three, *one*-two-three. . . ." Once again the effort ended in what seemed to Cordelia a very good start on a clinch, if only one party or the other would gather the wit and nerve to follow through.

Aral shook his head, and they backed silently away around the shrubbery. Apparently a little inspired, his lips found hers to muffle his own chuckle. Alas, their delicacy was futile; an anonymous Vor lord wandered blindly past them, stumbled across the terrace

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nook, freezing Kou and Drou in mid-step, and hung over the stone balustrade to be very traditionally sick into the defenceless bushes below. Sudden swearing, in new voices, one male, one female, rose up from the dark and shaded target zone. Koudelka retrieved his stick, and the two would-be dancers hastily retreated. The Vor lord was sick again, and his male victim started climbing up after him, slipping on the beslimed stonework and promising violent retribution. Vorkosigan guided Cordelia prudently away.

Later, while waiting by one of the Residence's entrances for the groundcars to be brought round, Cordelia found herself standing next to the lieutenant. Koudelka gazed pensively back over his shoulder at the Residence, from which music and party-noises wafted almost unabated.

"Good party, Kou?" she inquired genially.

"What? Oh, yes, astonishing. When I joined the Service, I never dreamed I'd end up here." He blinked. "Time was, I never thought I'd end up anywhere." And then he added, giving Cordelia a slight case of mental whiplash, "I sure wish women came with operating manuals."

Cordelia laughed aloud. "I could say the same for men."

"But you and Admiral Vorkosigan —you're different."

"Not . . . really. We've learned from experience, maybe. A lot of people fail to."

"Do you think I have a chance at a normal life?" He gazed, not at her, but into the dark.

"You make your own chances, Kou. And your own dances."

"You sound just like the Admiral."

Cordelia cornered Illyan the next morning, when he stopped in to Vorkosigan House for the daily report from his guard commander.

"Tell me, Simon. Is Vidal Vordarian on your short list, or your long list?"

"Everybody's on my long list," Illyan sighed.

"I want you to move him to your short list."

His head cocked. "Why?"

She hesitated. She wasn't about to reply, *Intuition*, though that was exactly what those subliminal cues added up to. "He seems to me to have an assassin's mind. The sort that fires from cover into the back of his enemy."

Illyan smiled quizzically. "Beg pardon, milady, but that doesn't sound like the Vordarian I know. I've always found him more the openly bullheaded type."

How badly must he hurt, how ardently desire, for a bullheaded man to turn subtle? She was unsure. Perhaps, not knowing how deeply Aral's happiness with her ran, Vordarian did not recognize how vicious his attack upon it was? And did personal and political animosity necessarily run together? *No.* The man's hatred had been profound, his blow precisely, if mistakenly, aimed.

"Move him to your short list," she said.

Illyan opened his hand; not mere placation, by his expression some chain of thought was engaged. "Very well, milady." ■

CONTINUED IN NEXT ISSUE

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Robert M. Zubrin & David A. Baker

MARS DIRECT: A PROPOSAL FOR THE RAPID EXPLORATION AND COLONIZATION OF THE RED PLANET

INTRODUCTION

Can the United States send humans to Mars during the present decade? Absolutely. We have developed a set of vehicle designs and a mission architecture that can make this possible. We call the plan: "Mars Direct."

The Mars Direct approach does not require any in-orbit assembly or refueling or any support from the Space Station or other orbital infrastructure. However, despite this, the Mars Direct plan is not merely a "flags and footprints" one-shot expedition, but puts into place immediately an economical method of Earth-Mars transportation, real surface exploratory mobility, and significant base capabilities that can evolve into mostly self-sufficient Mars settlement.

In this article we will present both the initial and evolutionary phases of the Mars Direct plan. In the initial phase, only chemical propulsion is used, sending four persons on three-year round-trip Mars exploratory missions. Two heavy lift booster launches are required to support each mission. In the second phase of Mars Direct, nuclear thermal propulsion is used to cut crew transit times in half, increase cargo delivery capacity, and to create the potential for true global mobility through the use of CO_2 propelled ballistic hopping vehicles ("NIMFs").

During the second phase of Mars Direct, as the exploration of the planet accelerates, a new strategy is also introduced, leading to the rapid establishment of a 48 person permanent Mars base. This base, in turn, acts as a construction team to prepare the economic infrastructure required to support a wave of colonists to follow.

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We shall show that the potential exists to colonize Mars during the twenty-first century at a rate comparable to that of European settlement of North America during the seventeenth, and that the colony so established can not only survive, but prevail, ultimately transforming Mars into a world habitable by humans and much of our kin of the terrestrial biosphere.

MARS DIRECT: PHASE I

The implementation of the initial phase of the Mars Direct[1,2] plan is shown schematically in Fig. 1. In 1997 a single shuttle derived "Ares" heavy lift launch vehicle (Fig.2) lifts off from Cape Canaveral and uses it upper stage to fire a 40 metric ton unmanned payload off on a minimum energy trajectory to Mars, where it aerobrakes and lands. This unmanned payload consists of the following: (1) an *unfueled* two-stage ascent and Earth return vehicle (ERV) employing methane/oxygen engines and including a life support system and enough whole food for four people for nine months, plus some dehydrated emergency rations; (2) six tons of liquid hydrogen; (3) 100 kilowatt-electric (kWe) nuclear reactor mounted within a small methane/oxygen internal combustion driven unpressurized utility truck; (4) a small set of compressors and automated chemical processing unit; and (5) two small robotic rovers.

As soon as the payload is landed, the 100 kWe reactor is driven a few hundred yards away from the landing site and lowered off the truck into either a natural depression in the terrain or one created by the robots with the aid of an explosive charge. Its radiators are then deployed and cable run back to the land-

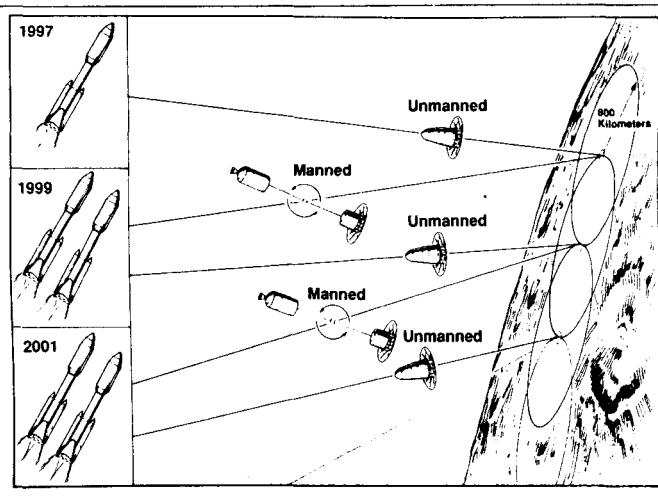

Fig. 1: The Mars Direct mission sequence. Every two years two boosters are launched. One sends an unmanned Earth Return Vehicle to fuel itself at a new site, the other sends a manned hab to rendezvous with an ERV at a previously prepared site.

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Ares Launch Vehicle Definition

Payload Capabilities (All Weights in tonnes)	
Trans-Mars (C_3 = 15 km²/sec²)	47.2
Trans-Lunar (5 day transfer)	59.1
LEO (160 by 160 Nmi, 28.5 degrees)	121.2
LEO/NUS (160 by 160 Nmi, 28.5 deg)	75.0
Height (m)	82.3
Gross Mass (Without Payload)	2,194.6
Stage-0	
2 Advanced Solid Rocket Boosters	1,214.5
Stage-1	
External Tank (Including Residuals)	35.6
SSME Engine Pod (4 SSME's)	28.6
Usable Propellant in ET	723.5
Total SSME Thrust (kN, 104%)	8,706
Specific Impulse (sec)	453
Staging Relative Velocity (km/s) (LEO to Mars Range)	4.2 to 5.5
Stage-2 (Ignited Sub-Orbital)	
Usable Propellant	158.8
Inert Mass	13.2
Single Engine Thrust (kN)	1,113
Specific Impulse (sec)	465
Payload Fairing (ALS Design)	20.4

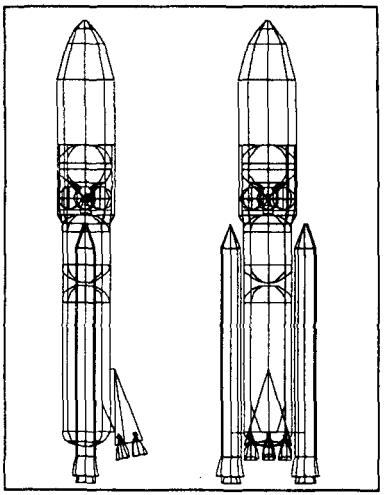

Fig. 2: The Ares launch vehicle can send 47 tonnes on direct trans-Mars injection, 59 tonnes to trans-Lunar injection, or 121 tonnes to LEO.

er. Then the reactor, which has not yet been used, is started up to provide 100 kilowatts of electric power to the site facilities. The compressors are then run to acquire carbon dioxide out of the Martian atmosphere (which is 95% CO_2). With the help of a catalyst, this CO_2 can be made to react with the 6 tons of hydrogen cargo, transforming it in a few days into 39 tons of methane and water. This being accomplished, we no longer have to deal with the problem of storing cryogenic liquid hydrogen on the surface of Mars. Next the chemical plant goes to work, electrolyzing the water into hydrogen and oxygen. The oxygen is stored as liquid oxygen, and the hydrogen is reacted with more CO_2 to create more methane and water, and so forth. Additional oxygen is produced by directly decomposing atmospheric CO_2 into oxygen and carbon monoxide, storing the oxygen and dumping the CO. In the course of 10 months, about 108 tons of methane/oxygen propellant is produced.

While this may appear somewhat involved, the chemical processes employed are 19th-century technology. The 100 kWe reactor isn't, but practical nuclear reactors have been operated since 1954, and the SP-100 in particular is currently scheduled to be ground tested in 1995, so that with the help of an accelerated program it can certainly be made ready in time for this mission.

It took 8 months for the unmanned payload to fly to Mars, plus 10 months to manufacture the propellant, for a total of 18 months. Since Mars launch win-

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dows occur at 26 months intervals, there is thus plenty of time for flight controllers to assure themselves that an adequate supply of methane/oxygen bipropellant has been produced to support crew surface operations and Earth return. If it has, in 1999 two more Ares boosters will lift from the Cape within a few weeks of each other. One of them is an unmanned payload identical to the one launched in 1997. The other is a manned spacecraft looking somewhat like a checker "king," 8.4 meters in diameter and 4.9 meters tall. Its two decks contain some 110.2 square meters of floor space, allowing it to accommodate a crew of four. With a mass of 40 metric tons (including parachute, landing propellant, provisions, and a pressurized methane/oxygen internal combustion driven ground car) it is light enough that the booster upper stage can project it directly onto a minimum energy ($C3 = 15$ km^2/s^2) transfer orbit to Mars without any Earth orbit refueling or assembly.

Once on its way to Mars, the manned habitat pulls away from the expended booster upper stage that launched it, but they are still connected by a tether 1,500 meters long. With the help of this tether, the empty upper stage can be used as a counterweight, and the assembly is spun up at one revolution per minute to provide a level of artificial gravity equal to the 3/8 gee found on the surface of Mars. When the manned craft arrives at Mars, the tether and upper stage are discarded, and the ship lands in the immediate vicinity of the now fully fueled ascent vehicle that has been waiting for it since 1997. The landing is safe because the robotic rovers sent out in the advance landing have identified and given extensive characterization of the best landing site in the vicinity, and photos of the site will have been used for astronaut training for the final touchdown. The ERV has a radio beacon much like an ILS transmitter at an airport, giving the crew exact position and velocity data during their approach and terminal landing.

In 1976, the United States sent two Viking probes to Mars, and landed them within 30 km of their designated target sites. With the help of the landing beacon, superior technology, advance meteorological data from the ground site, and the on the spot decision making capability of a human pilot, we can vastly exceed the degree of landing precision demonstrated by Viking, and land within a few meters of our desired touchdown point.

But even if we missed by a considerable distance, the mission plan has built into it three layered fallback options, a defense in depth to assure the safe return of the crew. First, the manned spacecraft carries with it a methane/oxygen driven pressurized rover with a one-way range of 1,000 km, so if worst came to worst, the crew could still drive over to their return vehicle. Second, if by some inconceivable mischance the crew misses its landing site by a distance greater than 1,000 km, they can still direct the second unmanned payload (which has been following them out a few days behind) to land near them. It contains a propellant factory of its own, and can thus act as an emergency backup. Finally, if all else

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fails, the crew has with them in their habitat enough supplies to last them until a relief expedition can be sent out two years later.

However, assuming that the manned landing has been carried out correctly at the prepared site, and the flight readiness of the 1997 ERV is verified, the 1999 unmanned lander will be directed to a second landing site 800 km away from the first. There it will begin manufacturing propellant for the second manned mission, which will be sent out in 2001.

Thus each manned Mars mission requires just two Ares booster launches; one to deliver a ride home, and the other to create a new outpost or add to an existing base on Mars. This is a much more economical mission than a conventional plan in which all the propellant is brought from Earth, which typically requires four to seven Saturn-V class booster launches each. The Mars Direct mission plan is superior to the conventional plan in another respect: Mars Direct brings all of the crew and their hardware to the surface where they can do their job of exploring Mars. The conventional plan requires leaving a mother ship in orbit around Mars, whose crew will accomplish little except to soak up cosmic rays. The crew on the surface is protected by Mars's atmosphere from most of the solar flare hazard, and with the help of some sandbags placed on top of their landed habitats, can be protected from cosmic rays as well. The vulnerability of the crew of the orbiting mother ship tends to create an incentive to limit the stay time of a conventional mission at Mars. This leads to very inefficient missions. After all, if it takes a year and a half of round-trip flight time to travel to Mars, a stay at the destination of only 30 days seems rather unrewarding. A not too rough analogy to such a mission would be planning Christmas vacation in Hawaii but arranging the itinerary to include nine days of transferring around airports going out and back, and half a day at the beach. Worse yet, in their rush to get back from Mars, the conventional mission planners are forced to take disadvantageous high energy orbits which drive up the propulsion requirements and thus the mass of the mission, as well as a swing-by of the planet Venus where the Sun's radiation is twice that at Earth. In the plan we offer, the crew will spend 500 days on the surface of Mars, coming back via the most efficient, "minimum energy" orbit possible.

During their 500-day stay on the surface of Mars, the crew will be able to accomplish a great deal of exploration. Using 12 of the 108 metric tons of methane/oxygen propellant to power their ground car, they will be able to travel over 20,000 land kilometers at speeds of over 30 km per hour, ranging out from their base 500 km in any direction. If a condenser is added to capture for later recycling the water vapor in the ground car engine exhaust, the 20,000 land kilometers available to the ground car can be increased several times over. Once the second lander's propellant production operation is well underway, they can even drive over to use it as a second base for forays. Thus about 1.5 million square km of territory will be

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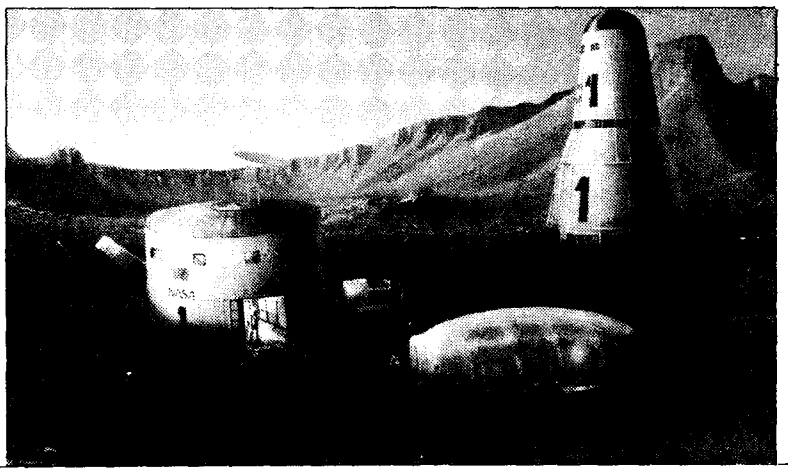
available for exploration for the first mission crew alone. With a crew of four, a large landed habitat/laboratory, and a substantial power source, a large variety of scientific investigations can be accomplished. In addition to searching for past or present life and clues to the planet's geologic history, one key item on the exploratory parties agenda will be to locate pockets of readily exploitable water ice. Once native water is available, it will no longer be necessary to ship hydrogen from Earth, and future missions and settlements can be made independent of Earth for their transportation and life support consumables. But even on this first mission, an inflatable greenhouse can be set up and extended experiments undertaken in growing food crops. If successful, the greenhouse can even be left in operation after the crew departs, allowing research to continue telerobotically from Earth, and perhaps providing future crews with both food and earthly fragrances.

An artist's conception of what the Mars Direct surface base would look like is depicted in Fig. 3. At the conclusion of the 500 days on the surface, the crew will climb into the methane/oxygen ascent vehicle and rocket back directly to Earth, where they will aerobrake into orbit and rendezvous with either the Space Station or be picked up by a shuttle. Quarters aboard the ascent vehicle will be somewhat cramped, but no more so than in the space shuttle. The return trip will be carried out under zero-gravity conditions, but it will only last about six months, and Mir cosmonauts have proven that zero-gravity exposure of such length can be tolerated

Fig. 3: Mars Direct surface base. Shown is the two-deck disc-shaped hab module, the two-stage conical methane/oxygen driven ERV, an inflatable greenhouse, and a pressurized ground rover. A 100 kWe nuclear reactor positioned in the crater in the background has long since completed its job of driving the production of the ERV's propellent supply, and now provides a copious source of power to the base, with backup power available from solar panels. (Painting by Robert Murray)



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by humans without excessive bodily harm.

Not too long after the mission 1 crew has departed Mars, the mission 2 crew will arrive and land their habitat near the unmanned ascent vehicle that had been sent out following the mission 1 crew in 1999. Accompanying them will be a third unmanned ascent vehicle/fuel factory payload which will be landed at a new site 800 km further along, to be used for return by the mission 3 crew which will depart Earth in 2003. Thus every two years a new base will be established and its vicinity explored, and before long a string of small bases will dot the map of Mars, separated by distances within the capability of available ground transportation. With just two boosters being launched every two years, the total launch requirement needed to sustain this program of exploration averages to only one launch per year!

The Mars Direct vehicle systems can also be used to accomplish Lunar missions in the following way. First, an Ares booster launch is used to throw a 59-metric-ton payload consisting of a standard hab module plus a cryogenic Lunar orbital capture and lunar descent (LOC/LD) stage onto trans-lunar injection. The LOC/LD stage is then used to land the hab on the Moon. After one or more such habs have been thus enplaced at a given site, the crew is flown out to the Moon within a Mars Direct ERV. The ERV in this case has its (Mars Ascent) first stage deleted, but its second stage is fueled with methane/oxygen bipropellant, and this provides sufficient thrust and delta-V for an Earth return direct from the lunar surface. Landing on the Moon at the prepared site is accomplished with the aid of the same cryogenic LOC/LD module used to land habs and cargo. After landing, the crew exits the ERV and enters the prelanded hab(s) and proceeds to operate on the Lunar surface for an extended period, after which they reenter the ERV and execute a direct return to low Earth orbit (LEO).

Prior to Lunar liquid oxygen (LOX) becoming available, the mass of the fully fueled Mars Direct ERV exceeds the Lunar delivery capability of a single Ares launch by five tonnes. This problem could be resolved by scaling down the lunar ERV by 20% compared to the Mars version. However if hardware commonalty with the Mars ERV is desired, a simple solution would be to preland a cargo flight of liquid oxygen at the chosen site. Since such a cargo flight could land about 21 tonnes of LOX, one such flight could support four manned missions to that destination (the ERVs would fly out fully fueled with methane and 2/3 fueled with LOX), plus any number of cargo flights. At the conclusion of these missions, Lunar LOX production could be in place and Lunar LOX available at the site, eliminating the need for any further LOX delivery flights.

This Lunar mission architecture has many advantages. First of all, no Lunar orbit rendezvous (LOR) is required. This is almost essential for a Lunar base mission (as opposed to Apollo short-stay missions), as it would be unthinkable to have astronauts exposed to zero-gravity and cosmic radiation in a Lunar orbiting craft while awaiting the return

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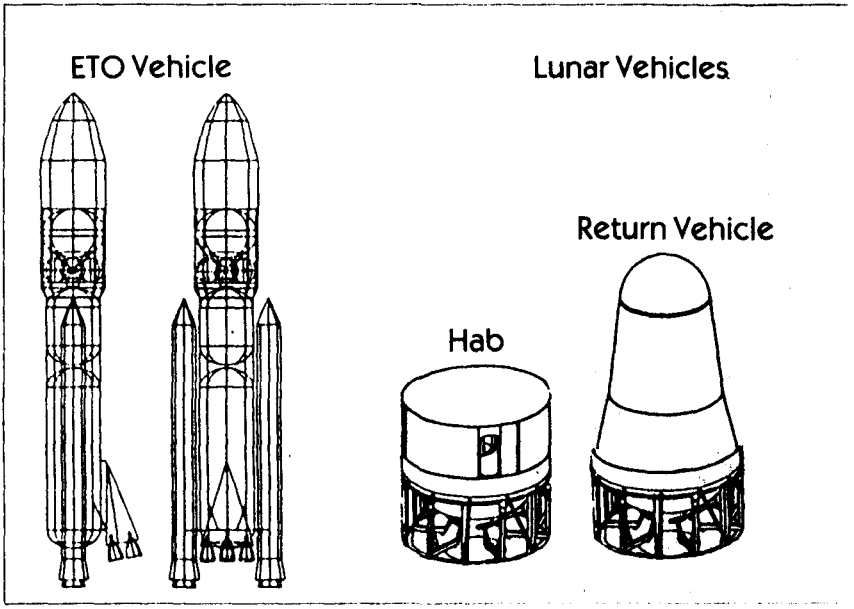
of a 6 to 12 month duration lunar excursion crew, and on the other hand landing the entire crew would leave the vital Earth return mother ship in an unstable Lunar orbit for an extended period with no one minding the store. If its condition were to deteriorate, only limited corrective action could be taken and the crew might be stranded; if a failure on board were to remain undetected until LOR, the returning crew would find itself in a very difficult situation. Secondly, the use of methane/oxygen for direct return from the Moon has advantages compared to either the hydrogen/oxygen or conventional storable bipropellant (NTO/MMH) alternatives. Compared to hydrogen, methane is almost indefinitely storable on the Lunar surface, thus facilitating extended stays. Methane/oxygen has a higher specific impulse than NTO/MMH (373 s compared to 343 s); however, once Lunar oxygen is introduced, this advantage becomes greatly multiplied and the effective Isp of the methane/oxygen system exceeds 1700 s. What this means is that using NTO/MMH, 25 tons must be landed on the Moon to return a 10-ton ERV to LEO, while using methane and lunar oxygen, only 13 tons need be landed. Thus 12 additional tons of cargo can be flown to the Lunar surface with every manned flight, which means that if one crew and one cargo flight are flown each year, the total cargo delivered has been increased 50%. Finally, the "Lunar Direct" architecture has the key advantage of being totally coherent with the Mars Direct architecture, using the same vehicles. Thus experience with Mars systems can be obtained in near-



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Earth space on lunar missions, and overall Space Exploration Initiative program costs can be greatly reduced through reduction in the number of elements of the total space transportation architecture.

The complete set of vehicles required for this combined Lunar/Mars Direct architecture is shown in Fig. 4. While no detailed costing of this architecture has been done, it is difficult to imagine how a Space Exploration Initiative based on such a limited number of hardware elements could cost anything resembling the $400 billion price tag frequently cited for more conventional architectures, including as they do orbiting space stations, cryogenic depots, and a raft of specialized space transfer and lunar and Mars excursion vehicles.

* * *

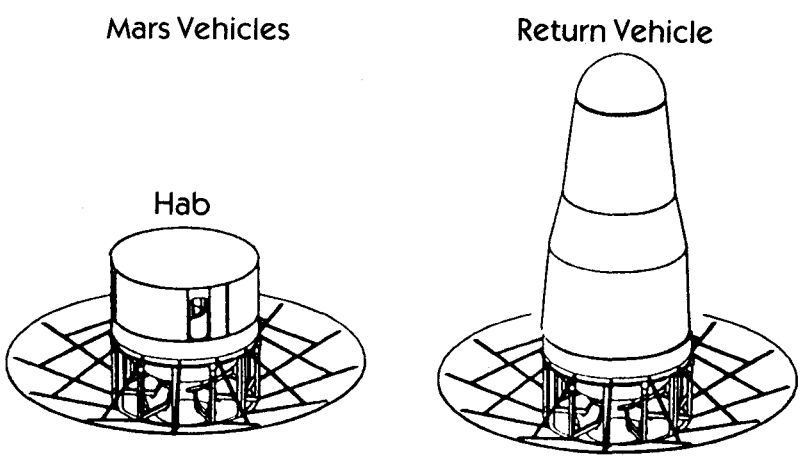
MARS DIRECT: PHASE II

NTR for Increased Payload Delivery

At some point after the commencement of this program, a new technology, nuclear thermal rockets (NTR)[3], will come into use that will allow us to greatly increase the payload transferable to Mars with each launch. It is the advent of such technology, combined with a reorientation of mission strategy from simple exploration to exploration plus base building, that marks the transition of the Mars Direct plan from Phase I to Phase II.

In keeping with the overall approach of the Mars Direct architecture, namely the elimination of the need for orbital infrastructure, NTR technology is incorporated into the plan simply as a third stage to the Ares launch vehicle. Such

Fig. 4: The complete space transportation system required to accomplish both the Lunar and Mars objectives of SEI using the basic Mars Direct system architecture. The high degree of vehicle commonality can help keep SEI costs to a minimum.



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a configuration is shown in Fig. 5. The NTR stage has a specific impulse of 900 s, a power of 900 Megawatts-thermal (MWth), and a thrust of 45,000 lb. With the addition of this stage the Ares can throw 70 metric tons on to a minimum energy trans-Mars injection (TMI) trajectory ($C3 = 15$ km^2/s^2), an increase of about 50% over the 47-metric-ton TMI all-chemical Ares baseline.

The performance of the NTR augmented Ares is limited by the fact that the NTR must be fired from LEO, and the baseline 2 stage Ares vehicle is not optimized for LEO delivery, as with 250,000 lb thrust its second stage is underpowered. (The 250 klb thrust is optimized for direct trans-Mars injection.) If the thrust of the second stage is increased, the LEO delivery capability can be increased, and the TMI throw also increased accordingly. Such results are shown in Table 1.

In the above calculation, NTR thrust to weight ratio of 5 and tank fractions of 0.1 are assumed.

Thus, if we augment the Ares upper stage to maximize its capability as a LEO delivery system, about 83 tonnes can be thrown to Mars with each launch (excluding the mass of the NTR stage, which is expended). This is about 77% higher than the Ares baseline, a TMI

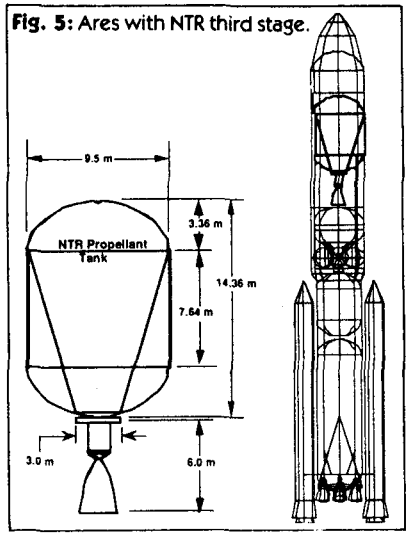

Fig. 5: Ares with NTR third stage.

mass increase of 35 tonnes, which translates into an extra 20 tonnes of cargo delivered to the Martian surface with each launch.

If we stick with our early plan of two launches per mission, this will allow us to increase our crew complement of each flight to 12. Alternatively, if the size of the missions are kept the same, using NTR will allow us to launch each mission with a single booster, instead of split between two.

As a third alternative, crew sizes can be kept at four for each two launch

Table 1. NTR Augmented Ares TMI throw Capability.

Stage 2 Thrust	*LEO Payload*	*TMI Payload*
250 klb	121 tonnes	70 tonnes
500	130	76
1000	144	83

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mission, but large amounts of cargo landed with them, allowing for the rapid buildup of a sizable base. Finally, if fast interplanetary transits are deemed important, the NTR stage can be used to throw a four-man Mars Direct hab onto a fast (80 to 120 day transit, $C3 = 50$ km^2/s^2) trajectory to Mars, while using its larger minimum energy TMI throw to deliver an ERV augmented with a third stage to the Martian surface. With the help of this third stage, the methane/oxygen driven ERV is able to execute an equally fast Earth return trip.

NIMF Vehicles for Global Mobility

NTRs can also be designed to use Martian CO_2 as their propellant. Since this can be acquired at low energy cost through direct compression out of the atmosphere, rocket vehicles so equipped will give Mars explorers complete global mobility, allowing them to hop around the planet in a craft that can refuel itself each time it lands. Such a vehicle concept, known as a NIMF [4,5,6] (for Nuclear rocket using Indigenous Martian Fuel) is illustrated in Figs. 6 and 7.

The NIMF vehicle shown in Fig. 7 has a 2513 MWth engine which generates 436 klb of thrust at a specific impulse of 264 s by heating CO_2 to a temperature of 2,800 K and exhausting it out a nozzle with an expansion ratio of 100. (The high molecular weight of CO_2, while very detrimental to specific impulse, allows for a much higher thrust to be generated by a NIMF engine operating at a given power level than a conventional hydrogen fed NTR of the

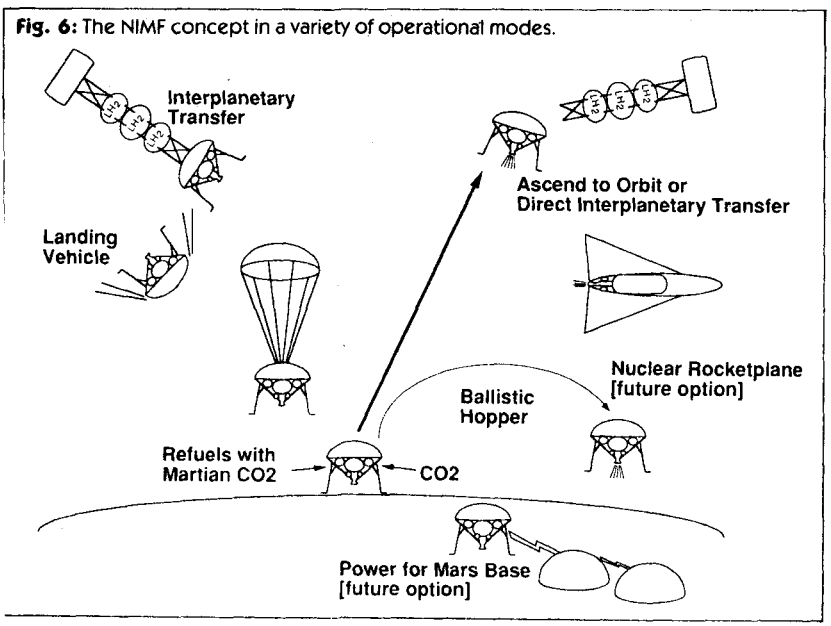

Fig. 6: The NIMF concept in a variety of operational modes.

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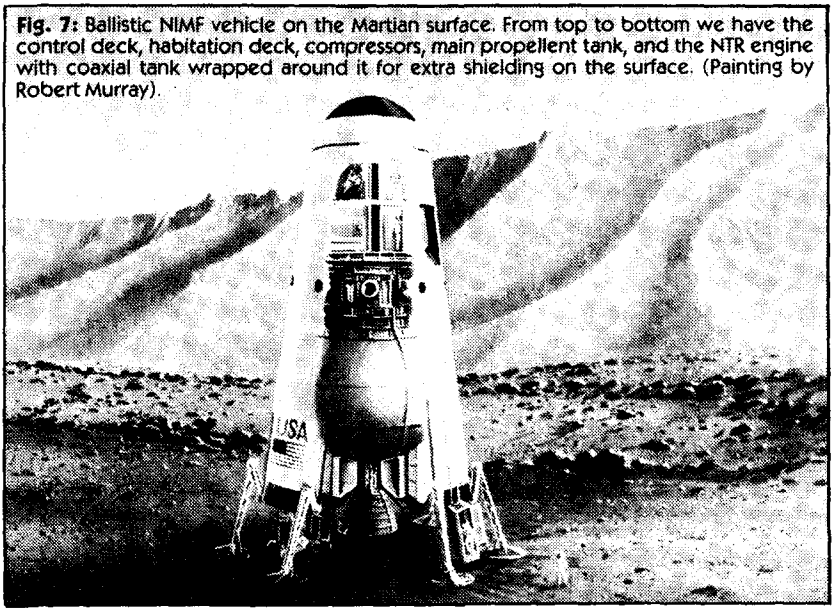

Fig. 7: Ballistic NIMF vehicle on the Martian surface. From top to bottom we have the control deck, habitation deck, compressors, main propellent tank, and the NTR engine with coaxial tank wrapped around it for extra shielding on the surface. (Painting by Robert Murray).

same power.) The vehicle, which has a dry mass of 45 tonnes, can contain a total of 346 tonnes of CO_2 propellant, giving it the capability of attaining a 250 km by 33,000 km (250 by 1 sol) elliptical orbit about Mars, or more importantly, enabling it to hop from one point on the surface of Mars to any other point in a single hop. In addition, the NIMF can carry significant amounts of cargo over continental-scale distances, as shown in Table 2.

Because CO_2 becomes an oxidizing medium when heated to elevated tem-

Table 2. Cargo Delivery Capability of the Ballistic NIMF.

Cargo (tonnes)	*Mass Ratio*	*Delta-V (km/s)*	*Range (km)*
10	7.03	5.047	Orbital
20	6.04	4.65	8500
30	5.23	4.28	6000
40	4.61	3.96	3920
50	4.13	3.67	3000
60	3.73	3.41	2280
70	3.41	3.17	1800
80	3.13	2.96	1450
90	2.90	2.75	1220
100	2.70	2.57	1000

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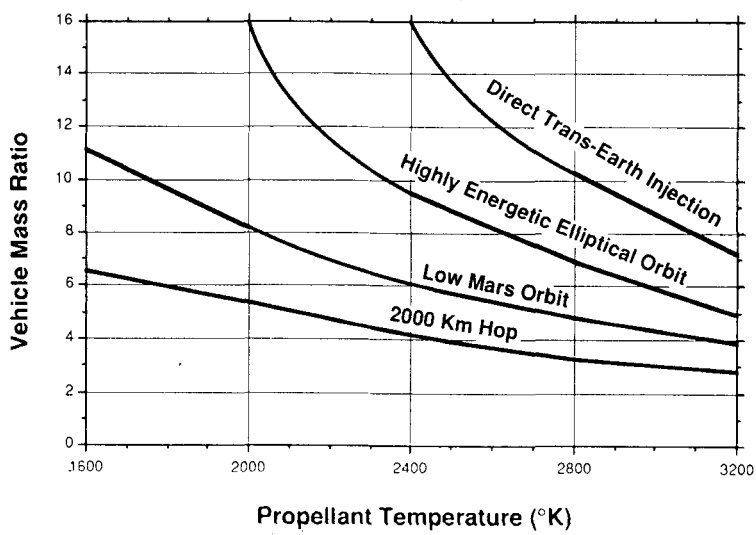
peratures, conventional NERVA[7] (Nuclear Engine for Rocket Vehicle Applications, developed during the 1960s) type carbide fuel elements cannot be used in a NIMF engine. Instead either oxide or oxide coated fuel pellets would have to be used. Uranium-thorium oxide has a melting point of about 3,300 K, and such pellets coated with a layer of either zirconium or thorium oxide to retain fission products could well enable operation at 2,800 K. Alternatively, preliminary data[8] indicates that "traditional" NERVA uranium carbide fuel elements coated with graphite can have their graphite coated with a further layer of thorium oxide, and that such thorium oxide outer coatings are resistant to both CO_2 and solid-solid reactions with the graphite at temperatures up to 3,000 K.

Because the actual propellant temperature attainable in NIMF vehicles is unknown at this time, it is useful to parameterize NIMF performance as a function of propellant temperature. Such results are shown in Fig. 8.

Since the NIMF vehicle shown in Fig. 7 has a maximum mass ratio of about 8.7, we can see in Fig. 8. that a propellant temperature of about 2,600 K is required if the 250 km by one sol orbit is to be attained. If all that is required is to attain low Mars orbit, which would still give the NIMF complete global mobility, then a 2,000 K propellant temperature is sufficient. Since this requirement is well below the expected range of performance, it seems clear that the development of NIMF vehicles capable of enabling full global access on Mars is an objective attainable within the limits of conservative engineering practice.

CO_2 can be liquefied out of the Mar-

Fig. 8: Performance of the NIMF as a function of temperature.



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tian atmosphere by simple pump compression at an energy cost of about 84 kWe-hrs/tonne. What this means is that the NIMF, using a 25 kWe power source (either dynamic isotope power source (DIPS), deployable solar, or dual mode NTR) can completely fuel itself in less than 50 days, without any dependence on surface infrastructure.

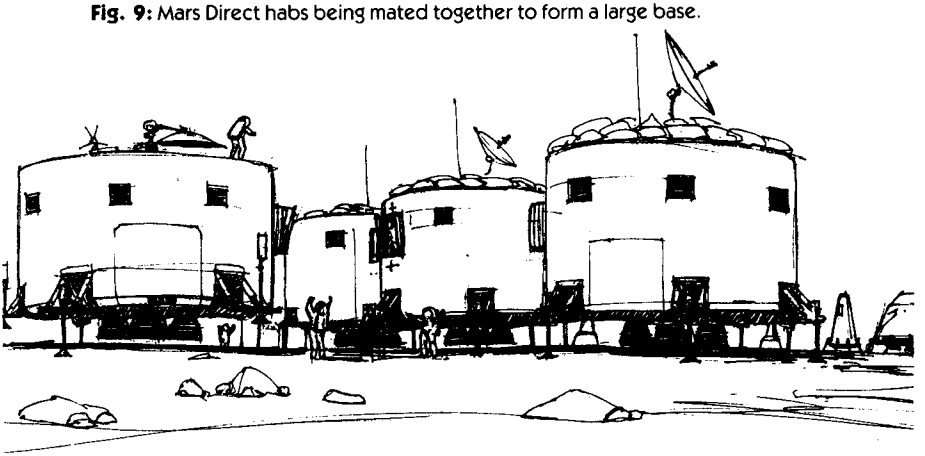
BUILDING A BASE ON MARS

Once NIMF vehicles have been developed and put into operation, there is no longer an incentive to land the Mars Direct hab modules in widely dispersed locations. Instead, landings can be concentrated at a single location chosen as a good site for a base during the Phase 1 period of surface exploration. Such a base will support the comparatively large population required to investigate and develop the industrial and agricultural processes needed to create a Martian civilization. While such research in extraterrestrial engineering and resource utilization is proceeding at the base, the field exploration of Mars can be continued at an accelerated pace by parties of scientists making long distance sorties in the NIMF.

In Fig. 9, we see a depiction of a group of habs landed in the same area being moved together to form a large contiguous pressurized volume. The habs' landing gear can articulate both in the vertical and horizontal directions, allowing them to "walk" the short distances required for hook-up.

Let us examine how such a base might be built up on Mars using the Mars Direct space transportation infrastructure. We assume that a period of Phase I type exploration has occurred, with minibases consisting of a single four-man hab modules enplaced in a number of locations, and that one of these sites has now been selected for build up into a major base. The results

Fig. 9: Mars Direct habs being mated together to form a large base.



(Drawing by Carter Emmart.)

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Table 3. Mars Direct Base Buildup Plan.

Date	Crew	Launches	Habs	Decks	Vol./person	Power	Cargo
—	4	1h,1e	1	1	32m^3	100kWe	15 tonnes
1/1	8	2h,2e,1c	3	3	48	300	75
3/3	16	2h,2e,1c	5	7	56	500	135
5/5	16	2h,2e,1c	7	11	88	700	195
7/7	16	2h,2e,1c	9	15	120	900	255
9/9	20	2H,2E	11	21	134	1300	385
11/11	24	2H,2E	13	27	144	1700	515
1/14	28	2H,2E	15	33	151	3400	645
3/16	32	2H,2E	17	39	156	5100	775
5/18	36	2H,3E	19	45	160	10200	935
7/20	40	2H,3E	21	51	163	12750	1095
9/22	44	2H,3E	23	57	166	15300	1255
11/24	48	2H,3E	25	63	168	17850	1415

are shown in Table 3.

In Table 3, dates are given as month and year starting from the launching of the team that founds the base. (The "—" mission refers to the Phase I expedition that initially explored the chosen site.) Launches are given as "h," "e," or "c," for hab, ERV, or cargo launches respectively, with lower case being used to describe a Phase I (chemical propulsion) type payload, and upper case for Phase II (Ares with NTR third stage.) The cargo column is a record of the cumulative amount of useful cargo landed at the base site.

The base buildup strategy is as follows. First a Phase I mission consisting of 1 hab and 1 ERV characterizes the site, staying on the surface and exploring the surrounding region for 1.5 years before returning to Earth. The site having been thus selected for development on the basis of intimate knowledge of its characteristics, the 1/1 mission consisting of 2 standard Phase I habs (1 hab deck, 1 cargo deck), plus 2 standard ERVs and one-way cargo launch is sent out. The 8-person crew of this mission will stay on the surface for 4 years, departing Mars 8/5. Such long stays offer the advantage of increasing the total man days spent on the Martian surface at any given launch rate by a factor of 2, as well as allowing each base crew to overlap its stay for 1.8 years with the team following on the next launch opportunity.

The second team departs Earth 3/3, arriving at Mars 10/3. This crew of 8 added to the 8 of the 1/1 team brings the base complement up to 16. Between the Phase I mission, the lower decks of the 2 habs of the 1/1 mission, and the two cargo launches (1/1 and 3/3), there are now 5 cargo decks/workshops at the base. This is quite sufficient for workshop space, and so the Phase I habs used on the 3/3, 5/5, and 7/7 missions are modified to accommodate habitation on both decks, thus giving the base a rapid expansion of living space per person, as shown in the volume/person column of Table 2.

Starting with the 9/9 mission, Phase

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II Ares launch vehicles with an NTR third stage are introduced, increasing the trans-Mars injection throw from 47 to 75 metric tonnes. This allows us to expand the hab to 3 decks, as well as ship about 25 extra tons of cargo with each hab or ERV launch. This eliminates the need for a separate cargo flight and enables the rapid buildup of emplaced base hardware, as can be seen in the landed cargo column of Table 2. While the 3 deck habs of Phase II can accommodate crews of 12, the 9/9 and 11/11 missions only fly with crews of 6 per hab, going to 8 in 1/14, 10 in 5/18, and 12 in 9/22, in order to increase the base crew size at a rate commensurate with the expansion of living space.

The 9/9 and 11/11 missions simply send out two 100 kWe reactors of the Phase I type with each ERV launch, but starting with the 1/14 mission, we assume that the reactor power system is switched from thermo-electrics to a Brayton cycle, increasing the power of each unit sent out to 850 kWe. One of these is sent with each ERV, leading to a very rapid buildup of base electric power capability. By the 25th year of the base, almost 18 MWe of power is in place, far, far, more than the 48 person installation needs for life support or propellant manufacture. Rather, this large amount of power will enable large scale materials processing, to produce materials to construct vast volumes of pressurized agricultural, industrial, and living space. The highly productive, mechanized, energy-intensive industry and greenhouse agriculture that these will contain will create the large-scale economic base required to support the flood of immigrants destined for this Martian Plymouth.

THE COLONIZATION OF MARS

"This proposition being made publike and coming to the scanning of all, it raised many variable opinions amongst men, and caused many fears & doubts amongst themselves. Some, from their reasons and hops conceived, laboured to stirr up & incourage the rest to undertake and prosecute the same; others, againe, out of their fears, objected against it & sought to diverte from it, aledging many things, and those neither unreasonable nor unprobable; as that it was a great designe, and subjecte to many unconceivable perils & dangers . . .

"It was answered that all great & honourable actions are accompanied with great difficulties, and must be both enterprised and overcome with answerable courages."

Gov. William Bradford,
"Of Plimoth Plantation," 1621.

By the 25th year of the Mars Direct base building effort, a large pre-built town, complete with housing, an electric power grid, and manufacturing and agricultural industries can be in place on the Martian surface. The stage is now set for the colonization of Mars.

The difficulty of interplanetary travel may make Mars colonization seem visionary. However colonization is, by definition, a one-way trip, and it is this fact which makes it possible to transport the large numbers of people that a colony in a new world needs to succeed.

In Fig. 10 we see a twenty-first century reincarnation of the Mayflower,

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used to transport immigrants to Mars. An Ares variant with a 1,000 klb thrust upper stage lifts 145 tonnes to low Earth orbit, then a NTR stage hurls the two 40 tonne "habcraft" onto a 7-month trajectory to Mars. After separation from the NTR, the two habcraft separate, rendezvous, and tether off to each other to create Mars's normal artificial gravity at a spin rate of one rpm with the aid of a 700 meter long cable. Arriving at Mars, the tether is dropped, and the habcraft aerobrake, parachute, and land separately on their own sets of hydrogen/oxygen engines.

Each habcraft is 10 meters in diameter and includes two complete habitation decks, for a total living area of 157 m^2 (1700 ft^2), allowing it to comfortably house 12 people in space and on Mars. Expansion area is available in the third (uppermost) deck after the cargo it contains is unloaded upon arrival.

Thus in a single booster launch, 24 people, complete with their housing, tools, and inflatable greenhouse, can be transported one way from Earth to Mars.

Now let us assume that starting in Base Year 25, or 2030 A.D., an average of four such boosters are launched every year from Earth (perhaps one from each of the four major spacefaring powers, although frankly an effort of this magnitude would be well within the resources of the United States alone.) If we then make various reasonable demographic assumptions, the population curve for Mars can be computed. The results are shown in Fig. 11. Examining the graph, we see that even with this minimal level of effort (and the technology frozen at ultraconservative late

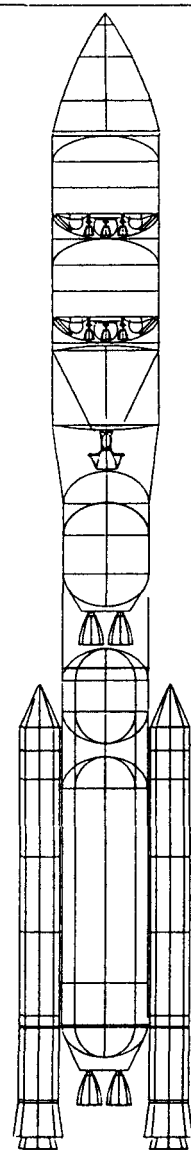

Fig. 10: The Martian "Mayflower," capable of transporting 24 colonists one way to the Red Planet.

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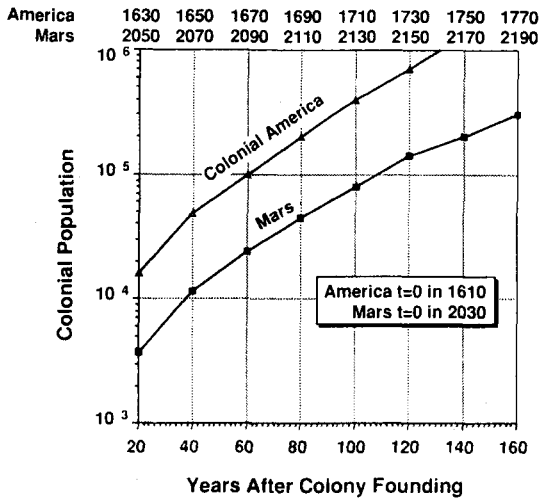

Fig. 11: Colonization of Mars compared to North America. Analysis assumes 100 immigrants/year starting in 2030, increasing at 2% annual rate, 50/50 male/female. All immigrants are between ages 20 and 40. Average of 3.5 children to an ideal Martian family. Mortality rates are 0.1% per year between ages 0 and 59, 1% between ages 60 and 79, 10% per year for those over 80.

twentieth century levels forever), the rate of human population growth of Mars in the twenty-first century closely approximates that experienced by colonial America in the seventeenth century.

This in itself is a very significant result. What it means is that the distance to Mars and the transportation challenge that it implies is not a major obstacle to the creation of a human civilization on the Red Planet. Rather the key questions become those of resource utilization, growing food, building housing, and manufacturing all sorts of useful goods on the surface of Mars.

Can this be done? We believe so. Unlike the Moon, Mars is rich in carbon, nitrogen, and hydrogen, the key elements needed to support life. Bring a few packets of seeds, several breeding pairs of rabbits and goats and some inflatable greenhouses to Mars, and a self-expanding agriculture can be established. Plastics, metals, glasses, brick, and concrete can all be manufactured out of native materials (many processes for doing so have been identified and presented in the proceedings of the Case for Mars [9,10,11] conferences) and used to construct large-scale greenhouses, housing complexes, and even environmentally protected towns. As discussed above, liquid fuels can be synthesized to propel high powered ground vehicles and construction equipment. The required expanding consumer electric power grid can be provided by importing additional nuclear reactors at a rate of one 850 kWe (dynamic cycle aug-

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mented) unit every four years, to start, with larger multi-megawatt units supplanting them later on in the program.

This latter requirement to import nuclear reactors brings up an important question. That is, while it is clear that a Mars colony could manufacture the large majority of its bulk requirements (consumables, propellants, housing materials), it seems equally clear that for a very long time there will remain a necessity to import a certain amount of high-tech manufactured goods from the Earth. The question is, is there anything that a Mars colony could export to the Earth to pay for such imports, or must Mars always be dependant upon Terran charity?

One answer is that the Martians could export knowledge. Mars colony could be set up as a university town, with intensive research going on to produce patents which could be licensed for profit to Earthside industries. This may well suffice; however, it is interesting to inquire whether there are any material goods which can be exported from Mars for a profit.

At first glance this seems absurd. After all, how many times have we heard that if there were diamonds lying on the surface of the Moon, it wouldn't pay to go there and get them; how much worse must the situation be for distant Mars?

Actually, if there were diamonds lying on the surface of the Moon, it would pay to get them, not by flying individual Apollo style missions, but by setting up a base with a catapult system and firing off the payloads to Earth. The situation on Mars, despite its long distance, is no worse, because at Mars we have indigenous propellant to work with.

Consider for example a large unmanned NIMF, a cargo NIMF if you will, capable of lifting 45 tonnes to Low Mars Orbit (LMO). If a methane oxygen stage is used to fire the payload from LMO to Earth, (where it aero-enters and is picked up on the ground after a parachute landing), about 40% of this payload in LMO, or 18 tonnes, can be useful cargo sent to Earth. Now the 45-tonne object in LMO weighs about 17 tonnes in Mars gravity, so for a desirable stage Thrust/Weight (T/W) of 0.2 for Trans Earth injection we need about 3.4 tonnes, or 7.5 klb of engine thrust. The typical T/W of a chemical engine is 40, so this means that for each 18 tonnes of useful cargo transported to Earth, an engine weighing 85 kg is required. Let's say that the tanks, and propellant and stage structure can all be manufactured on Mars, but that the engine must be imported, along with another 35 kg of spare parts to replace high-tech items expended in the course of producing the cargo or launching the NIMF. Thus 18 tonnes of cargo can be transported to Earth at the cost of 120 kg of required imports. This mass transportation ratio, which we term "M," is thus 18,000/120 = 150 for this example.

The balance of trade ratio, or "B," which determines whether the Mars colony can produce any income, is then given by:

$$B = UMP \qquad (1)$$

where P is the ratio of the price per kg of the Mars-produced cargo on Earth

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divided by the cost per kg (production plus transportation costs) of the Earth-produced items, and U is the fraction of total Martian imports than can be expended to support the export operation (the rest is used to support the colony).

To continue with the example, lets say that U = 0.1, and that the cost of terrestrial imports is $10,000/kg (which is about what if would be if a 121 tonne to LEO class Ares with an NTR third stage costs $500 million per launch). Then if the Martian-produced goods are worth $1000/kg on Earth, we find: B = UMP = (0.1)(150)(0.1)) = 1.5, and the Mars colony is producing a 50% profit.

What could Mars produce that is worth $1000/kg on Earth? One possibility is minerals. Cordell[12] has shown that the history of the Mars, as we know it today, implies that ore-forming processes have occurred on Mars in the past, over an extended period of the planet's geologic history. Thus, while it must be said that such ores have yet to be discovered, geologic science indicates that Mars may be as richly endowed with mineral ores as was the natural Earth. However, unlike the Earth, Mars has not had 4,000 years of human civilization acting to scour up all the easiest to discover and richest ores, so that there is every reason to believe that Mars may possess an abundance of valuable ores far exceeding what is readily available on the Earth today.

If this proves to be the case, then there are a large number of items that can potentially be extracted from Mars and exported to Earth for profit, as shown in Fig. 12. Here we have stuck with our above example for the transportation

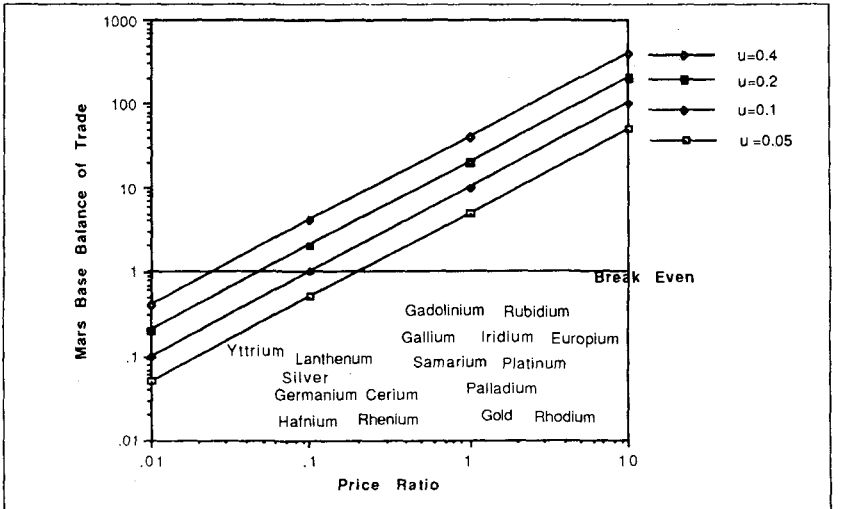

Fig. 12: Mars base balance of trade. It can be seen that if valuable minerals do exist on Mars, their exploitation with large profit margins is possible.

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ratio, assumed $10,000/kg costs for imports to Mars, current mineral prices, and examined a range of U values. It can be seen that, while there is considerable uncertainty in the analysis, if minerals at least as valuable as silver or germanium are available on Mars, (and there are many such candidates), then a profitable Martian export operation can proceed.

It may be added that the introduction of advanced propulsion technology beyond NTR can improve this picture further. For example if a set of solar[13] or magnetic[14] sails were placed in operation cycling between LMO and a trans-Earth injection orbit, cargo delivery could be accomplished solely by operation of these craft in conjunction with the cargo NIMF. The need to export methane/ oxygen engines in large numbers would thus be eliminated from our previous example, and the mass transportation ratio, M, would be increased from 150 to 514, with a very large benefit for the Martian economy.

TERRAFORMING MARS

One hundred years after the commencement of this colonization effort the population of Mars will reach 80,000 people, and a sufficient industrial base will have been established for serious terraforming operations to commence.

McKay[15] has offered two design points for a terraformed Mars. Basing himself on the near conclusive evidence[16] that Mars was a warm wet planet for the first several billion years of its history (as shown by dry river channels and other water erosion features) he and his collaborators have proposed recreating the primeval greenhouse effect on Mars by reendowing the planet with the same 2 bar (1 bar = 14.7 pounds per square inch (psi) pressure) CO_2 atmosphere that it had in its childhood. The problem with this proposal is that while 2 bars of CO_2 is required to produce a Mars where the average equatorial temperatures are above the freezing point of water, only about 0.3 bar of volatile CO_2 is actually believed to be currently present on Mars (in the atmosphere, as south polar dry ice, and absorbed in the soil), the rest having become chemically bonded to form carbonates.

McKay's second proposal is to endow the planet with a 1 bar nitrogen/oxygen atmosphere. Since these gases are not major greenhouse effect contributors, in this scenario he proposes supplementing the atmosphere with a "mixed cocktail" of selected artificial CFC gases which have greenhouse potential several orders of magnitude higher than CO_2. The CFC gases $CBrF_3$ (Halon), C_2F_6, CF_3Cl, and CF_2Cl_2 would all be stable in the Martian atmosphere with half-lives over 200 years, and would not be toxic to humans at the ppm levels required. A production rate of about 100,000 tonnes per year of this mixture would be required to sustain a greenhouse effect on Mars sufficient to raise the equatorial region's temperatures to Earth temperate zone levels (currently about 650,000 tonnes of these gases are produced per year on Earth). The estimated power required to support the steady state CFC manufacturing on Mars to maintain this greenhouse would be about 500 MWe, although a production of 1,000,000 tonnes/year (5000

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MWe) would be required if the greenhouse is to be established within a 40-year time span. These requirements hardly seem excessive for a project of this value. The problem, however, is that while the CFC greenhouse appears technically feasible, the nitrogen/oxygen atmosphere does not, as chemically free nitrogen is not to be found in anything like the required quantities on Mars.

Given this situation, our proposal is for a compromise combining what is most feasible from the two McKay scenarios. That is, what we propose is to set up the CFC production on Mars and start to greenhouse the planet despite the fact that no nitrogen/oxygen atmosphere is to be had. The first thing that will happen as the planet starts to warm is that the CO_2 as dry ice in the south polar ice cap will vaporize, thickening the CO_2 atmosphere, and adding to the greenhouse effect of the CFCs. Within 40 years, nearly all of the volatile CO_2 can be made to outgas, forming an atmosphere of about 0.3 bar pressure (4.4 psi) on Mars. While this atmosphere would not be breathable by humans, it would eliminate the need to wear pressure suits. Rather, humans working on the outside on Mars would be able to wear street clothing, along with a kind of scuba gear breathing a mixture of 3 psi oxygen and 1.4 psi nitrogen out of a tank. As temperatures rise, the water frozen as permafrost into the Martian soil will begin to melt and flow again into the long dry river channels of Mars. Soon the rains would begin to fall, and it will become possible to grow plants in the open across large regions of the planet. Within 100 years of the commencement of the terraforming effort, desert areas such as Chryse Planitia may be covered with amber waves of genetically modified grain, while the lower slopes of the Olympus Mons are decorated with proud stands of Ponderosa pine.

These plants will do more than produce food and look grand; they will transform Mars's atmosphere, just as their ancestors did for the Earth. The atmosphere they create will be nearly pure oxygen, at about the 3 psi level. As the experience of the Apollo and Skylab programs prove, humans can function quite well for extended periods of time in such an atmosphere. Thus, with the help of our biospheric allies, the day may come when humans standing on the surface of Mars doff their breathing gear and gratefully breathe in the cold crisp air of the Martian spring.

In 500 years, a space of time equal to that which separates the present age from that of Columbus, a civilization of over a billion people may live on a new Mars, a world not discovered, but created by the courage and enterprise of the human spirit.

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concept and Al Schallenmuller has provided corporate support and assistance with the analysis of the methane/oxygen production process. ■

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About the Authors

Robert M. Zubrin and David A. Baker are senior engineers at Martin Marietta Astronautics, working on advanced space transportation systems.

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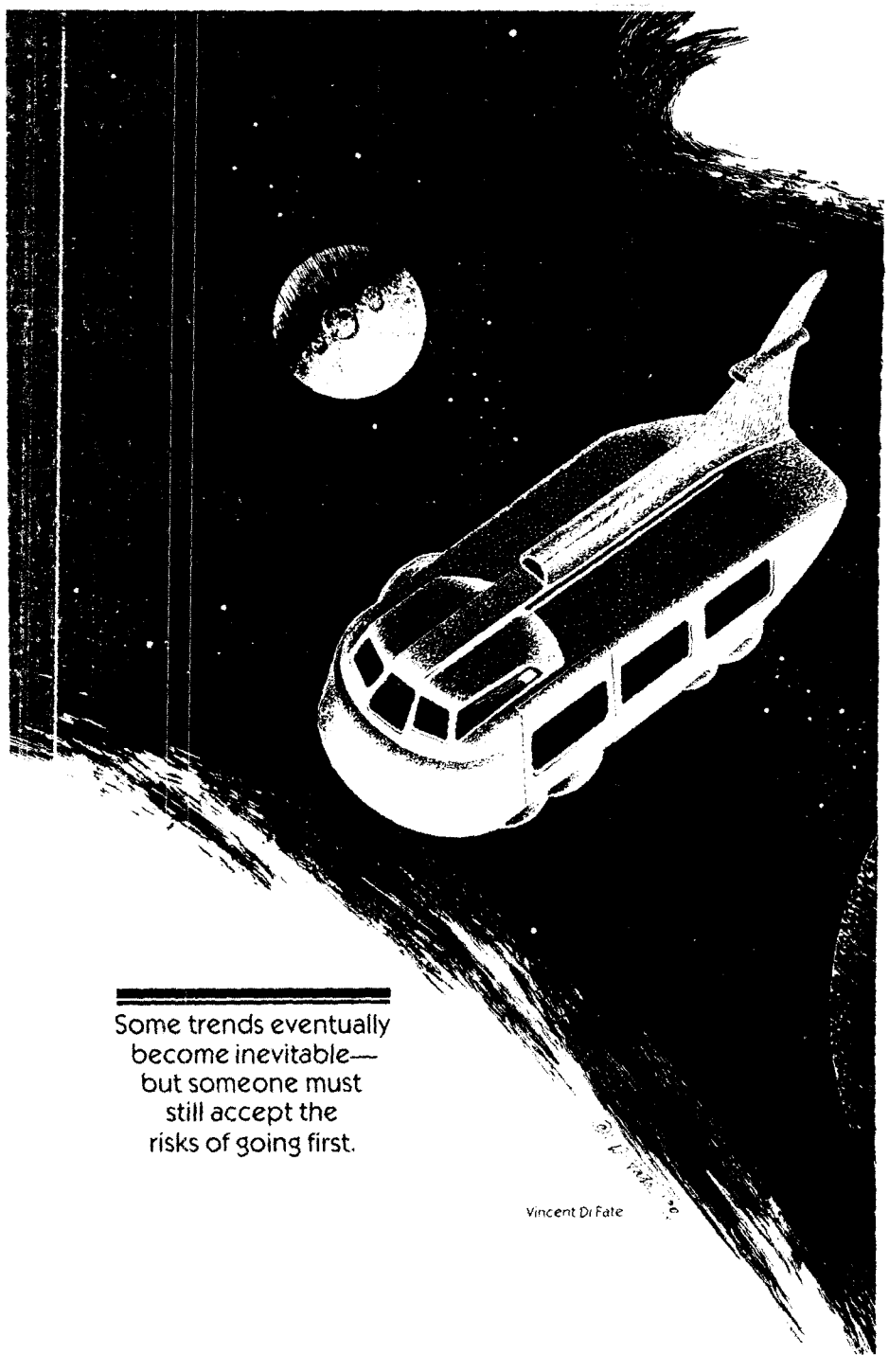

Some trends eventually become inevitable— but someone must still accept the risks of going first.

Vincent Di Fate

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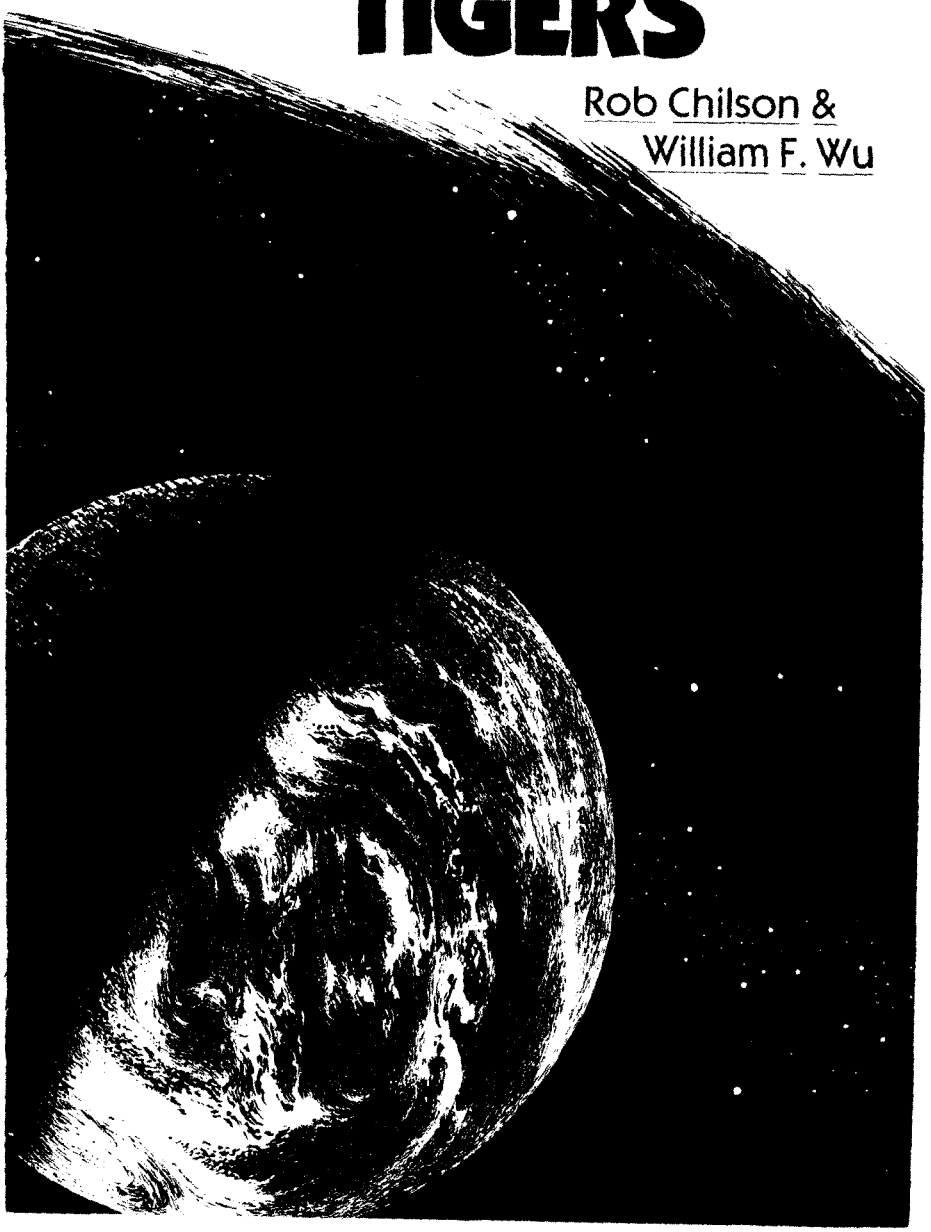
DISTANT TIGERS

Rob Chilson &
William F. Wu



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The aircar was all packed. Roger Li paused to catch his breath and look it over before leaving the hangar. He couldn't afford to forget anything. What he was contemplating was as dangerous as crossing the ocean in a small boat, as they used to do in the twentieth century.

It was a transcontinental station wagon, a "San Martin," made by VIDA of Brazil. This model had room for nine passengers and luggage, and could cruise horizontally at a thousand kph until its nuclear cans were exhausted, after some five years. It was six meters long by two wide, and one and a half high, and had two forward doors and a dorsal hatch in the sloping tail section. It was blunt and square-looking despite the rakish but purely decorative vertical fin on the hatch.

Roger had removed all but the first row of three seats. He had fashioned a tiny airlock inside the right front door by gluing two sheets of transpex together to make a closet-sized, three-sided room one and a half meters high. One sheet had a door cut into it. Roger had removed the original outer door and brazed a class "C" space hatch over the opening—the standard personnel-only hatch, designed to mate with any other of the same size. The left front door and the rear hatch were glued shut.

He peered through the open airlock. The floor was cluttered with supplies. In the slope-roofed tail section was a box housing the air purifier and gleaming cermet bottles of reserve air. Before them was a camp toilet behind a curtain. Forward of that, he had stashed two sleeping bags and suitcases. A camp fridge, boxes of food, and bags of water completed his cargo.

So far.

In the house, he quietly opened the door to Marta's room and was careful to stop it before the slanting edge of light from the hall reached her eyes.

Smiling at her peaceful, sleeping face, he drew back the covers and lifted her to his shoulder, careful to support the weight of her head as he raised her. He picked up her special blanket in one hand and arranged it clumsily over her shoulders.

"Can I have my Buffalo Bill?" she asked quietly, reaching down toward a toy box of stuffed animals.

Roger concealed his surprise. "Sure, sweetie," he whispered. He stooped, holding her so that she could grab the big stuffed bison by one soft horn. She held him in both arms as her father carried her to the hangar.

"Are you sure you still want to come? You don't have to. You can stay with your mother if you want." He felt guilty saying it. She was seven, too young to make such a decision.

She shook her head. "You said I could go."

"Of course. I love you." Roger kissed her chubby cheek. He could tell that she was very sleepy but he also knew she was excited. She would be awake until they were on their way.

"Can I say goodbye to Mom?"

"Uh, no, I'm afraid not, sweetie. It's an odd time to call and she might suspect. You know she loves you very much."

Marta nodded and chewed thoughtfully on one of the buffalo's horns.

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Roger set her down in the window seat. Once they were in the air, and she was asleep again, he could move her to her sleeping bag. Now, though, she was awake—and said she was hungry.

"All right." Roger sighed. "Wait till we take off and I'll get you a Chewy-wich."

He eased them out of the hangar and into the air. They circled the modest house that for three years had been home, looking solemnly down at it, stark in the street lights. Then he took them into the sky.

"Daddy, where are we going?"

Excited, Roger looked down at her. "Don't you remember? I've told you several times."

"Tell me again," she said with matter-of-fact innocence.

Roger laughed and ran his hand through her black hair. "We're going to Eureka, remember?"

"And we're going to be rich when we get there."

"Well, not exactly. But by comparison, we will be. I'll have steady work and plenty of other possibilities. Yeah, we're going to be rich."

Marta thought this over quietly. She probably didn't really know what the word meant.

He watched her eat with a mixture of wonder and concern. She was normally an aggressive child, strong-willed and active. For all of her seven years, she had been a determined kid, often hard to discipline but easy to admire for her persistence. For days now, though, she had been subdued and thoughtful. Clearly, she understood much of what he had told her—that they were leaving her mother, probably forever, and that they were going on a very dangerous trip, one on which she would have to obey her father without any protest. At her age, though, she could not really understand the forces behind this flight.

Sometimes Roger wasn't sure he did, either.

For now, he was more concerned about the trip itself. The aircar's basic functions were sound. The gravitronic motor had only been developed a few years ago, but it was proven; it had no moving parts, so it wasn't likely to fail. The nuclear-electric can was also highly reliable. Nor was he too worried about the air purifiers and so on. They were all off the shelf.

He hoped his seals held. He hoped his calculations were right. He hoped they got away.

Roger cut forward speed to zero and increased lift. He held their acceleration to about twice that of an elevator until his controls told him he was climbing at over fifty kilometers per hour. Presently Marta's head eased back against the seat. She still held her stuffed companion snugly in her arms. Already the stars were out: they were above the overcast. Putting the car on automatic, Roger carried his daughter carefully to her sleeping bag. She sighed and moved a little, but did not awake.

Back at the controls, Roger was tormented by doubt. What was he getting her into, after all? It's our lives I'm betting, he thought grayly. Her life I'm betting.

He hesitated, but he had exhausted all the alternatives long ago. They'd be above the atmosphere by midnight. As soon as they were, he'd put the car on "hover," which would cause them to

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accelerate straight up at one gravity—and he'd keep it on.

Roger was dozing in his seat when he felt the familiar small hands and bony knees of his daughter climbing into his lap. He opened his eyes and put one arm around her; she, in turn, had one firm arm around Buffalo Bill's neck. "Hi, sweetie," he said, his voice hoarse. "Something the matter?"

Marta looked solemnly out into the starry night. The car seemed to be hovering motionless in the sky. A strange black sky, with no ground visible. Earth was invisible far below them; it could not be seen through any of their windows.

They had flown out of the shadow of Earth, thrown by their retained rotational velocity. Now Roger would keep the Sun under them, charge the hull with electricity to ward off the solar wind, and pray. The thermo-electric elements kept the car cool enough, but the floor and walls were warm to the touch. The windows were edged with flame from the sunlight below.

"Where are we?" Marta asked.

Roger cleared his throat. "We're nearly halfway to the Moon, sweetie." Luna was visible off to the right, as if on the horizon.

"Oh." She considered the stars thoughtfully. Finally, unexpectedly, she asked, "Are we going to be like the tigers?"

Startled, Roger laughed. "Sure. You like that one?" He used a light tone, to see if she would turn playful.

Marta nodded, meeting his gaze solemnly.

Sobering, Roger recited:

"The mind desires to roam,
The soul aspires to soar,
But Earth's a fettered prison
Without freedom's ancient lore.

My seeking mind turns outward
To tropic jungles and the night,
Where cold-eyed tigers freely prowl
To hunt and dream and smite."

Marta said sleepily, "It's always night out here," and touched her nose to his. He kissed her cheek.

"Do you know one about buffaloes?" she asked, cuddling.

"Uh, yeah, I know a song about where buffalo roam. Or used to, at least. Shall I teach it to you?"

"Yeah!"

"OK." Roger paused to get the lyrics straight and as he did, he reflected that buffaloes had been confined to zoos and parks even longer than tigers. "Oh, give me a home . . . "

As he sang and cuddled his daughter, Roger brooded over his position and course. He had been brooding over the course for days. They were approaching turnover time for travel to the Moon or L Clusters, and still piling on gee. Luna, of course, was nowhere near his line of flight. He would pass near the L-4 Cluster as space distances go, but it would scarcely be visible.

The transponder had beeped occasionally—it sounded off audibly when tweaked by questing beams, even as it responded. Now Roger shut off its responses. To have come out without filing a flight plan or with a silent transponder would have been a giveaway; the Patrol would have been all

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over him at once. Now, though, maybe he had left it on too long.

As it was, the transponder had beeped every fifteen minutes or so since he had first been warned of his deviation from his LEO destination. They knew where he was, how fast he was accelerating, and in what direction. Where were they?

Roger hugged his daughter, sang louder as she joined in the chorus. He couldn't help glancing around at all the windows, expecting to see the prow of a CisLunar Patrol Ship, evil menace incarnate, loom near them. If they caught him, he would lose his daughter.

He could think of nothing else to do. He could only run.

In addition to space ships, roughly a million aircars were flown into space every year, to Spaceworld, the Wheel of Chance, and other destinations in Low Earth Orbit. Approximately one in a hundred of the aircars was space-proofed for the jump to the Moon or the L Clusters. That was about twenty-seven cars a day. And every now and then some fool tried to bypass Emigration or Customs—this year Galileo Station was the favorite of immigrant vacbacks and salt smugglers.

These were the occasional prey of the CisLunar Patrol Ship *Rojo*, now swinging around Earth in a watchful orbit, far below the Patrol's HQ in Terra Minor Station. However, by far its most frequent duty was rescuing legitimate but hapless ships and cars.

Karl Flachsner and Wilhelm Krege, CLPS *Rojo*'s crew, were both from Germany, but conscientiously used English on duty as regulations required.

"An alert," Wilhelm said, interrupting Karl's story about a tavern he had visited. "It's from Orbital Watch."

Karl swung around to watch his screen.

The look-down radars and lasers were tracking a car coming out of the midnight line. It would have been lost among the average 112 cars lifting off Earth every hour except that it had not turned over at the halfway mark for a Low Earth Orbit destination. The computers had plotted its trajectory. Karl picked up that plot and frowned.

"Looks like a vacback. He's going too fast for any of the LEO stations."

"Orbital Watch has informed him of his deviation from his filed flight path."

"Yes. Orbital Watch's transponder picked up his license—and he doesn't have a space-proof cert. He's ours."

"It will be a long chase, since we're on the other side of Earth and going the wrong way. At this phase of the Moon, L-4 is closest to his flight path." Wilhelm punched a course into the flight computer. "He may reach L-4 first."

That would not be good on their records, Karl thought. Extricating him from one of those hostile colonies could be a nasty job. "If he's a vacback, I can't say that I blame him. I think TLL is setting its standards for emigrants too high."

"Even if they aren't, the waiting list now is over a year."

"Meantime, the colonies go hungry for men," said Karl, brooding over the near end of his own tour.

He had applied for emigration months ago, but Europe's waiting list just to be reviewed was months long.

"You know what they tell us." Wil-

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helm shrugged. "We don't wish a return of the bad old nationalistic days."

The unexpected invention of the gravitronic motor had revolutionized life on Earth as well as in space. The wing, the wheel, and the sea-going hull were all made obsolete, with disastrous economic results. Borders also suffered heavy pressure, and were visibly becoming obsolete, too. Panicked, the world's politicians had scrambled to protect their positions by regulating use of the motor. One of their first efforts was the International Space Usage Treaty, which gave a monoploy to its creation, Trans Lunar Lines. TLL deliberately formed a bottleneck for outgoing emigrants and raw materials imports alike, to ease the pressure of cheap spaceside goods.

Small private ships were exempted from the monopoly, as being economically insignificant. Nobody had foreseen the small motor or the aircar, let alone the drop in price of gravitronics.

"No," Karl admitted. "But I don't think TLL's choking grasp is quite what the Signatories intended."

TLL's CisLunar Patrol self-consciously drew on a concert of nations for its labor pool to maintain its image as a neutral organization, and Germany had a long line of volunteers. Soon, Karl reflected, his rotation would be over. He would miss space.

He glanced at Wilhelm as his partner watched his own screen. Wilhelm had been a good partner. He would miss space, too, Karl thought. Time passed. Then Karl's detection cast got no response. Frowning, he tried again.

"No transponder?" Wilhelm said alertly.

"No. But I am locked onto the car with clidar, so it is a small matter." Karl studied the Coherent Light Detection And Ranging display, switched it to doppler, frowned. "Wilhelm?" he said nervously. "I don't think he's turning over. He doesn't seem to be decelerating at all."

"Ach. You're certain?"

"I'm not certain. I only have him on doppler laser, but his velocity relative to ours is not decreasing as rapidly as I could wish. We are overtaking at a rate of about eight kilometers per second. It should be nine. His velocity relative to Earth must be sixty-four; ours is about seventy-two. Notify Sky Watch and discover if the quarry ever responded."

Karl and Wilhelm looked solemnly at each other.

"Yes, he may have had a breakdown, this Roger Li," said Wilhelm, worried, and he turned to his radio again.

The aircar hovered, seemingly motionless, in space. It was accelerating straight up, its horizontal motors off, at one gravity, and had done so for hours.

It was normally a three and a half hour flight to the Moon or L Clusters, Roger knew. That included braking down for half the distance. He had kept that sched for the first 105 minutes; then he didn't brake down. He sat sweating, not from the heat. The radiation counters were merely chuckling quietly to themselves; let there be no storm on the Sun!

The second half of the Moon-distance should have taken another 105 minutes, under deceleration. Instead, it took 41.

Still no sign of pursuit. He had all communications off, lest he have to ex-

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plain to Marta why he wasn't answering. Now, he wondered if that had been wise. He felt very alone out here. Where was the Patrol?

Marta was dozing beside him, her face flushed a little with sleep. It was now after two in the morning, and despite the nap she had had that afternoon, she was behind on sleep.

They must be approaching the orbit of the Moon. Already Luna was a little below their horizon, so that he looked down to his right at it. It was brighter and larger than he'd ever seen it, but not much. Of course he'd never seen this face of it. That cluster of stars off to their right must be the L-4 Cluster, Roger thought. It was much nearer than the Moon, and still a little above the horizon, drifting slowly downward.

He debated waking Marta to watch the Moon pass behind the L-4 Cluster; it would be the last "sight" on their trip.

Roger had been idly watching the video, sound muted. A news show flashed Sheila's face at him. Startled, he nearly dropped his coffee cup. After a moment he reached out hesitantly and turned up the sound to a mutter.

"—Suppose he was taking her for a trip to one of the amusement parks in space," Sheila was saying, distraught, near tears. "I just hope she'll be all right!"

"CisLunar Patrol reports that one of their ships is closing on the derelict aircar now and should make contact soon," said the interviewer with professional calm.

Roger started again.

"They've only been in space for two and a half hours," said the interviewer. "An aircar can hold its air for that long."

"I hope so," Sheila said, anguished.

"That's Mommy," said Marta very quietly beside him. She looked up at him. "Mommy's on vid. Are they talking about us?"

"Yes." Roger cleared his throat. His heart was pounding, but he kept his voice casual. "Marta, you remember what I told you about bad men trying to stop us from reaching Eureka?"

Her eyes were very big as she nodded up at him. She quickly looked back at the video, but her mother's image was gone. A still photo of Roger and Marta was up. Roger muted the sound.

"There's a ship coming for us now. We'll have to hide."

But where? he thought in sudden despair. An intruder would only have to bump its Class C hatch against his and step into the triangular airlock to see the whole interior of the aircar; the transpex of course was transparent. Hide under the tarp or behind something? Ridiculous; there was nothing big enough even for Marta to hide behind, unless he moved the boxes of food out from the hull. That would be obvious to anyone.

The transponder beeped. Nervously, he looked around, out all the windows and as much of the view "above" as he could see through the sloped windshield. No Patrol ship was in sight, though it might be too far away to see.

Most likely it was approaching from below, braking down to match velocities. He could make it impossible for them to close with him, of course, but then they'd take sterner measures. Firing a low-speed rocket to cling and puncture their hull with a slow leak was

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the usual method of subduing carloads of drunks.

"Marta, we'll put our space suits on," he said, getting up. "You'll like that, won't you?"

She nodded solemnly, though the girl-sized suit had excited her when he had first brought it home and repaired it. She knew as well as he that this was no time for play.

As he was helping her into it, crouching under the low overhead, he had an idea.

When they were suited up, Roger crouched sweating in the personnel lock, leaning partly out. The aircar was only a meter and a half from bottom to top, about five feet—a head shorter than Roger. His first act on opening the Class C hatch had been to peer down past the car's floor, illimitably down, *down*, to look for the Patrol ship. He had found only stars and stark fear, and now he looked resolutely at the jamb of the lock.

Marta was crammed into the tiny space with him.

"OK, Marta, can you wiggle out here on the edge?"

She did so gingerly, gripping him with the clumsy mittens of her suit. He could hear her panting breath, but she straightened resolutely, to stand partly outside the car, the top of her helmet over the upper edge of the hatch, looking over the car's roof. Dim in the shadowed helmet, her brown eyes were huge as she looked in, down, at him.

"Remember what the Wizard of Oz said?" Roger asked. He worked to keep the strain from his voice. "Little girls are braver than anybody. I hope I don't faint when it's my turn."

Actually, the Wizard had said that little girls are fiercer than anybody; they'd read *The Lost Princess of Oz* only a month before. Marta didn't correct him, but he didn't think she smiled, either. After a moment, she cautiously released her death grip on his arm and slowly raised her hand over her head to grip the slippery top of the curved Class C hatch. Because of the inward curvature of the hull, the hatch stood out from it; he had had to build up behind it. He held her ankle tightly.

In another moment she had both hands on top of the hatch. Reaching between her legs, Roger put his palm on her bottom and pushed, slowly, steadily, as Marta pulled up, scrabbling a little with her toes. Then she was balanced precariously on her stomach, her breathing panicky. Roger put his palm under one foot and pushed up gently, taking the strain as she pushed down.

Then she was over the top of the hatch and crawling over the roof of the aircar. He let go of her ankle and thankfully grabbed the hatch jamb.

Roger balanced on the brink of that eternal fall for long moments. Then he swallowed and looked up, tilting his head and bumping his helmet against the jamb. Despite the sweat in his eyes, he saw Marta's helmet as she peered down. He risked a small wave, knowing he couldn't speak without squeaking.

Cautiously, ever so cautiously, he leaned farther out, gripping the jamb with his slippery gloves, turning slowly and raising one hand. After an eternal moment—Marta didn't make a sound—his groping fingers closed over the top of the hatch. Turning more to face

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the car, he released his grip on the jamb and tried to bring his other hand up.

For a moment he froze half in the lock, half out, with one slippery grip on metal, the other hand poised. The slightest breath of air would send him hurtling down, down, forever down.

Then Marta's mitten closed on his wrist. Gently, she guided his hand to the top of the hatch while he gasped despite himself. But it was better than groping blindly.

When he dared, he took a deep breath, still crouched partly in the lock, his rear end out over emptiness. Roger had a flash of amusement at the picture he must present. Gripping the hatch like grim death, he leaned back and raised his head, his features contorted in a wrenched grin that had real amusement under it.

He straightened his legs slowly, feeling them tremble, feeling his arms quiver. Now he was standing straight up, leaning a little back, and the top of the hatch was even with his chin. His hands were positioned too closely for him to pull himself up easily; he had nothing to grip on top of the car; the lock gave him nothing to stand on. He needed a *boost*.

Roger hung there panting, trying not to panic.

The car was as stable as a rock, accelerating upward at a steady ten meters per second squared. The eight lift motors—two at each corner—gave it great stability, aided by the gyro motors under the floor. Circular, they generated the same inertial effect that a gyroscope did, but without moving parts. The car would not shift under his weight.

Tentatively Roger reached out. Marta eagerly seized his hand, flung her weight on it, and spread her legs to maximize drag. Roger pulled against her weight, tiptoed, and pushed down with his other hand on the hatch. He hoped his brazing held! Then he had his belly across it and was kicking frantically at the sides—and then he was on top, gasping for breath and hugging Marta clumsily through her suit. She clung to him fiercely, saying, "Daddy, Daddy, Daddy!"

Everything was all right now. Almost. The car's roof was nearly two meters wide, and the front four meters of its length were level; then it sloped down in the tail hatch with its fin. Ample room. He had covered the roof of the aircar with glass-foam insulation against dust particles. It was already pocked here and there with pits left by tiny sand-grains.

After he had recovered a little from the sheer terror of climbing up, Roger reached over and turned off Marta's radio, then his own. Putting his helmet against hers, he said, "If we leave the radios on, they might hear us. But we can talk like this. You can go back to sleep if you want."

She nodded inside her helmet, but she remained awake and alert, her eyes on him most of the time. He could hardly blame her. His heart was pounding and his blood racing with fear.

Time passed; Roger almost dozed.

His first warning was Marta's gasp. Raising his head, he saw it, too: the blunt silvery prow of a CisLunar Patrol Ship. Roger instantly ducked his head and pressed Marta's down, as well. It was coming up on the right side of the car.

Tugging on her suit, Roger led them

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in a scuttle to the left, as far away as they could get. If the ship came up alongside them, it was all over. A hundred to one, he thought, despairing.

Again the silvery prow loomed, closer now, stubby and square, totally without streamlining. A cluster of sensors of various kinds protruded from it, but most were focused on infinity ahead of them. Roger, lying flat, head sideways, blinked sweat out of his eyes.

It was all for nothing, Roger thought in despair. When the Patrol had glanced at the interior and seen nothing, their next move would be to look on top: the only place the fugitives could have hidden.

It had been a long chase, but CLPS *Rojo* was at last closing on the derelict aircar. The first estimate had been that Roger Li was making for the L-4 Cluster. Instead of tracking the car, however, Sky Watch had simply made the same assumption. When they realized that Li was out of control and bypassing L-4 widely, Karl Flachsner and Wilhelm Krege were well off his line of flight and had had to correct course.

"I wouldn't want to be in Sky Watch's Computation Section tonight," Wilhelm said.

"The aircar is several thousand kilometers ahead," said Karl.

"Yes, I see him," said Wilhelm. They were both tired now; Wilhelm's voice was strained.

Wilhelm increased acceleration till they had nearly closed with the quarry. Then he eased off the acceleration, eased off more, swore a little and piled on a little more gee. After a while, the car became visible to the bare eye as an oval. It grew as Wilhelm brought them up under it.

Karl worked into his suit, cursing the coin toss that had cost him this duty and dreading what he might find in the aircar.

"He has fastened a Class C hatch to his hull. Look, Karl, that ring of lights," Wilhelm said.

Karl nodded somberly.

"This simplifies things, Karl. I shall bring our forward personnel lock against that, and you can—Karl!"

A surge of the ship had given them another, closer look at the hatch. Horrified, they stared. It was open.

"Ach—bring us alongside, Wilhelm."

Wilhelm nodded and brought them within range. Then he turned the chore of docking over to the computer.

Karl waited in the forward personnel lock, his queasiness not helped by the series of tiny surges with which the computer brought them alongside the quarry. There was the usual ringing clang as the ports mated.

Karl irised the hatch open. The hatches mated so closely that it was only a stride across them. After a last hesitation, he ducked through.

Inside, two transpex sheets made a crude airlock. Crouched in this three-sided space, he reported mechanically to Wilhelm. As Regs demanded, everything was being recorded.

"Ingenious," he said. "A homemade airlock. But as we feared, the aircar is empty."

"Empty, Karl?"

"Empty of human life. I can see forward; there are three seats in the cabin.

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A video receiver is on. A stuffed toy has fallen between the seats. To my left, I can see the rest of the car. All the other seats have been taken out. I see sleeping bags, air bottles, a camp fridge. This ingenious Roger Li sought to emigrate to the L-4 Cluster prepared for emergencies."

"I wish all our vacbacks were as thoughtful," came the tinny voice of Wilhelm, calm with professionalism and shock.

"He couldn't have guessed that he would . . . fall out of the airlock," said Karl emptily.

Always in his mind was the knowledge that disaster awaited him, too. If the vehicles should lurch apart, the locking mechanisms of the ports would snap open, letting him fall between the hulls. Even if he wasn't crushed, it would take Wilhelm a long time to recover him in space.

Li and his daughter had had no one.

"What about the car?" Karl asked. "Shall we bring it back?"

It would take another two and a half hours to bring it to a stop, then another five hours to take it back to Earth, since it couldn't accelerate much above one gee. That meant seven and a half hours in a visibly unsafe vehicle.

"I think not," said Wilhelm.

"Very well, I will return at once. Signal our findings and disposition of the aircar." Karl took a step backward, and gripped the hatch of his own ship from the inside. He irised it shut with a thankful sigh, disengaged the clamps holding the vehicles together, and held on as Wilhelm swung their prow sideways to break contact. Then Karl felt the elevator-dropping sensation of cutting acceleration.

Stumbling into the control room, Karl said, "Poor fellow."

"I hope he didn't have the daughter with him, Karl."

"I saw two sleeping bags," said Karl shortly.

"Himmel. What do you suppose happened?"

"Thank God we do not have to decide. That will be for a Board." Karl struggled out of his suit.

"What a tragedy."

The Patrol ship was still in docked position. Roger held Marta and hardly dared to breathe when suddenly she jerked convulsively and grabbed at him. She turned her helmet toward him and he glimpsed her agonized face; she was crying out.

He started to put his helmet to hers to ask what was the matter, when he saw the plume of air and water vapor above her back beside the airbottle. She'd been holed by a sand grain.

Shocked, Roger put his gauntleted finger over the hole to block the outflow of air. Marta pounced on him, banging her helmet against his, screaming. It echoed hollow inside his helmet, inside his head.

Wounded, he thought, dazed. *Oh God, now what do I do?*

Patch it. But he had no patch. He had only brought the suits for remote contingencies; he hadn't expected to use them. Besides, he'd have to hold a patch tight to her, and she could barely stand the pressure of his finger. Yet if he released it, she would erupt into vacuum.

There was only one thing Roger could

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do. Picking up Marta, he rose to his knees, crying, "Here we are! Patrol, come in!"

Another of those ringing clangs jarred the car and sent him sprawling to the roof, Marta rolling over, flailing for him. The blunt prow of the CisLunar Patrol Ship vanished, falling like a dropped stone below the top of the hatch. They had gone, leaving him alone with his dying daughter.

"Wait, wait, wait! Come back!" Roger crawled weeping to Marta, and again put his hand on her back. She clung to him, helmet against his chest, and he heard her crying out, a great wordless cry of pain and fear.

Lifting her, Roger crawled on his knees across the foam to the edge, peered over. The Patrol ship was a gleaming dot far below. It shrank to a point, vanished. They had been abandoned.

He'd have to get her back into air immediately.

For a moment he debated swinging her down into the lock, then he considered going first. He decided to go first; there might not be room after he had swung her down. Reversing, he thrust his legs over the top of the hatch and instantly realized his error; it would be easier to swing her down from above than to pull her from below.

Too late now. He lowered himself with frantic scrabbling haste, thinking of the fountain of mist above her back. To his fevered imagination, it seemed red. Then his feet found the bottom of the hatch. He reached for Marta and she crawled swiftly to him, crying out soundlessly in pain and fear of being left up here alone.

He could duck inside, he realized, and cut the acceleration to a tenth of a gee, but cycling the lock would take too long. Nor could he leave her alone.

Pulling gently, he got her to the edge, and though she obviously couldn't use her right arm, she scrambled around to come down feet first. Crouching, he guided her feet as she sank down and into the lock. For a terrible moment, she was half suspended, her pain too great for her to grip well. They nearly fell out several times. Then he had her in the lock, weeping now rather than screaming.

Crowding them as far from the hatch as he could, Roger irised it shut thankfully. Leaning against it, painfully relieved not to be poised over that endless drop, he reached awkwardly behind himself and, after a moment of panicky groping, cracked open the spill valve in the door. Air rushed in around them and he opened the door. They fell backward into the car.

Blood covered Marta's back. Hastily, cursing his gauntlets, Roger unfastened her suit, jerked his own helmet off, got halfway out of his suit, and got the damned gloves off.

Marta was crying now with pain, most of her fear gone. "Daddy, it hurts, it hurts," she moaned, clinging to him.

"Yes, sweetie, let me get the aid kit—"

The wound was a raw strawberry, but not deep. It was bleeding freely, leaving astonishingly bright red blood all over her and inside her suit and all over the floor. Already a purple bruise was forming around the wound, wider than the palm of his hand, partly from the blow

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and partly from the expansion of the flesh in low pressure.

Roger's first shaky act was to press gauze against the wound, but that caused her to scream in agony. Broken ribs, he thought. But I've got to stop the bleeding first. At least she wasn't actually fighting him.

He decided to forego antiseptic—it was bleeding freely—and he gingerly replaced the gauze, quickly crisscrossing it with tape. The bleeding slowed, and Marta had only gasped or cried out once or twice.

Breathing more freely, Roger gently felt her small torso and decided that the ribs weren't badly displaced. The grain of sand had barely penetrated the suit, he thought, and the blow had been transmitted over a wide area.

"I'm going to read the book for a few minutes, sweetie," he said. "Meantime, if you'll take these pills and lie very quietly, it won't hurt so much."

Disengaging her clutching hands, Roger rose to a crouch and brought water. Marta looked at him, her dark eyes solemn and trusting as she drank. Then she closed her eyes, sighed, and slumped down in her pool of blood. Pain twisted her mouth, but she gave nothing more than an occasional whimper.

Hands shaking, Roger paged through the handbook.

Marta slept for a long time after Roger had tended her wound and strapped her ribs with the elastic bandage from the aid kit. He concluded that nothing more would be needed before they reached Eureka, where he'd have her X-rayed. Apparently the analgesic worked; she did not whimper in her sleep.

Roger himself, despite the terrible tension he was feeling, stretched out and tried to relax, praying nothing big would hole their roof or curving, unprotected sides. He even dozed from time to time, with the lights turned down low. Once a restless movement from Marta alerted him, and twice he was jerked out of his doze by the transponder beep as it was swept.

In every conscious moment, guilt nearly overwhelmed him. He could have come alone and left her safely on Earth.

At length he was awakened by Marta, who reached over and tugged at his hair with her left hand.

"I'm hungry, Daddy," she whispered. "And my back hurts."

"That's good. Good that you're hungry," Roger said, rousing himself slowly. Together they made an illustration for a children's book: "Beauty and the Beast." Crawling on hands and knees, he scrounged some food for her, turned up the video—the Space Olympics were on the news channel—and checked the time. Hours had passed since they had left Earth. Had their little trick actually thrown the Patrol off?

While Marta munched, Roger unfolded the screen and ducked behind it, used the portajohn and took a hasty sponge bath. He felt much better. Then Marta used the john and he helped her with a rather sketchy bath. Finally, he soaked off the bandage while she gripped the floor mat in silence, eyes tearing quietly.

"Let me have my Buffalo Bill," she gasped.

Roger got the stuffed animal for her and while she hugged it, he wondered

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if he should disturb the scab this way. The book just said that the dressing should be changed lest wounds become infected. Fortunately, he did not cause her too much pain, or open the wound badly. He cleaned away much of the crusted blood and it looked better. Then he dusted in the antiseptic powder and taped fresh gauze over it again.

"Do you wish it never happened?" she asked very meekly.

"Oh, yes, of course," Roger said quickly, realizing he had not been as attentive to her fear as to her wound. "Of course I do, sweetie. But you'll be OK. You have cracked ribs, I'm afraid, but they aren't badly broken—it just means you'll have to be careful not to bump them. Your right arm will be stiff and sore for some time. You'll have to be careful how you use it—we'll probably put it in a sling. The big sore on your back where the meteorite hit you is healing. It will be sore for a long time, but it will get well. I'm afraid you'll have a scar." He was convincing himself as much as her.

"I like to sleep on my stomach more anyway," she said, and slowly got to her knees. Rocking back, as Roger curbed his ache to help, she slowly stood, her head just below the ceiling. For a moment, she tottered, obviously dizzy, then flashed him a short smile. Carefully she walked forward, bent to pick up Buffalo Bill in her left hand, and stepped delicately between the seats. She sat down, but could not lean back.

Roger got a cushion for the left side of her back and she was reasonably comfortable.

"Can we watch cartoons?" she asked.

The video had gone to fuzz.

"Let's see if we can pick up a space-side broadcast." Roger scanned the channels, using the special space-band tuner. All he got was something from the Moon about local problems. "Here, let's plug in a record button. Rocky and Bullwinkle, or—"

"Crock O'Dyle!" Marta said firmly, suppressing a gasp as she incautiously moved her arm.

Roger sighed. This cartoon Irish alligator worked at the Gideon Kleinmein Home for Helpless and Houseless Horses, and his toothy brogue was heard in every child-inhabited home on Earth, if not the Solar System. Still, her enthusiasm was a good sign.

As he was wrapping elastic bandage experimentally around her shoulder for a sling, Marta looked up from the video. "How long before we get there?"

Roger was first appalled, then pleased, at the time that had passed. "About three more days. We've been underway for a full day already. I can't understand it, unless the Patrol really thinks the car is empty." Roger realized that he hadn't really believed they could do it, not since he'd seen the menacing prow of the CisLunar Patrol Ship. "We'll keep on going up for another day, then we'll turn over and start backing down." He had put foam under the aircar, also.

"And nothing will happen to us?"

"I hope not," he said. "Maybe the patrol will catch us yet. Something else bad could happen, too. But maybe nothing will. Why worry till it does?"

She looked up at him and nodded, resting in pain on her cushion. Then she turned back to the video.

Just in time. Roger nearly broke down.

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* * *

Several times in the next twenty-four hours, Roger Li heard the muffled thump of impacts on the glass foam above their roof. Nothing got through, he thought; at least he heard no hiss from their ceiling. Not yet.

"Are we all right?" Marta would ask, after each thump, and Roger would check, heart pounding, and say, "Yes, I think so."

Marta would then go back to drawing and coloring, Buffalo Bill ever nearby. Her faith in Roger pained him. Marta had even ceased to look out the windows.

Roger couldn't. Once he had caught a flash of motion and had looked quickly at the window. Some speck of dust had stroked the window, flaring instantly into a tiny supernal spark that left a white, vertical scratch. Looking more closely, Roger saw that all the windows had at least one such scratch on them, and that there was a finer frosting of tiny parallel lines, indistinguishable at a distance.

Now he glanced frequently and feverishly at the windows.

Roger had read that the impact of a meteorite went up as the square of the velocity. So if he were going three times as fast as he had been, the impact would be three squared, or nine times, as violent as impact at the lower velocity. Any of the grains of sand or dust that struck their top now would have killed Marta outright, though they were no larger than the one that had hit her.

Roger judged that they were at last halfway to Eureka, at midnight of the second day. Two days up, he had decided, two days down. He had decided to fly straight up, as nearly as he could, from the midnight line of Earth, hoping that the rotation of the planet would throw him eastward sufficiently to bring him near Eureka.

Endless days of calculating had gone into this, so many that he'd missed the favorable moment to launch for Juno, one of the biggest asteroid cities. If he'd known astrogation, he could have shaped a direct course. As it was, he was trusting to luck, and the alertness of the inhabitants of Eureka.

Roger and Marta had gotten on a skewed schedule, partly because of her wound, and she was still awake.

"Come strap in, sweetie," Roger told her, and Marta obediently followed his clumsy duck walk to the front seats.

Strapping in was an awkward business because of her injuries, but they managed it without too much pain for her. She bore it stoically and watched him solemnly as he took the controls.

First Roger cut out the circular stabilizing motors. He felt no perceptible difference, though he might have if he had moved about. Then he progressively cut power to the lift motors. Second by second, weight drained away, like a very gentle descent in an elevator. Then they were at the "bottom": seeming motionless and floating.

To amuse Marta, who had been very quiet the past two days, Roger held out his pen and "dropped" it: it hovered, then began to drift. In a moment it was out of reach. Marta smiled a little when he stretched but could not retrieve it. The fans wafted it gently away.

"Time to turn us," he said.

He gave a touch of power to the forward motors while he reversed the drive

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of the aft motors. In a moment, the car was pitching up, slowly, slowly, while the stars wheeled around them. Roger watched his artificial horizon and let the car wheel till it showed them as nearing 180 degrees.

Reversing the motors for a moment, he watched the artificial horizon breathlessly. He had undershot. Now he pushed them a little farther over, overshooting, and brought them back. Sweating, he compensated again, then again.

"It's harder than I thought it would be," he said.

The long narrow shape of the aircar had a high moment of inertia. A sphere would be easier to rotate. Finally Roger had the vehicle as nearly on line as he could get it. Great precision probably didn't matter much in any case—he had no idea if he was really on a good course for Eureka or not.

Kicking in the stabilizers, he eased in power on the lift motors, increasing it gradually until they were on hover at one gravity. He reset the artificial horizon, and it flopped from 180 degrees to normal.

"Are we going down now?" Marta asked.

"Yes," he said absently. "The Sun is over our heads now."

At least the windows were now protected by the bulge of the car's sides. Brilliant light came in through them and through the slanting windshield in front. That would fade as they got farther away, and the thermo-electric elements would keep the car cool. Roger hoped there wasn't too much radiation; there'd be UV for sure.

"Stay out of the sunlight," he said, unnecessarily.

Marta would have had to climb up on the dash to get into it, but she nodded solemnly.

For another day, they'd be in severe danger from dust and sand grains, but then their velocity would slow till those impacts would be less ruinous. Roger hoped that the glass foam underneath would ward them off as well as that overhead had done.

Presently they slept, and woke again: still in space, still free. Still in the tiny, cramped aircar. Lying motionless, Roger contemplated getting up and felt that he would develop a hunchback, or at least a permanent stoop, before long.

He was vaguely conscious of having heard Marta afoot. When he raised his head, he found her and Buffalo Bill surrounded by a litter of dried apricots he had rather romantically bought for the expedition. Behind her was an opened box of chocolate sugar-frosted 7-grain puffs, the nauseating concoction that was her favorite snack—Marta never ate them for breakfast. Cookies and toaster-tart packages had also been rifled. It was a wonder he hadn't wakened by the sound of the gunfire, he thought, focusing on her blearily.

Marta swallowed heroically before he could speak. "It wasn't me!" she said. "It was Buffalo Bill."

Rubbing his eyes, Roger looked at the slandered toy. It looked guiltily back at him, a dried apricot protruding from its little mouth. "I believe you," Roger said. "A larcenous brute, if ever I saw one." He clambered slowly to his feet, bent under the overhead, burdened more with his age than she with her wound.

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As Marta scrambled to her feet to help him, several apricots dropped out of her sling. Roger pretended not to notice.

"Are you cold, sweetie?" he asked.

She was wearing her sweater. His own chill had just struck Roger; in fact, that was what had awakened him. Before, they had been so warm that they had been sleeping with only sheets over them. He was all but shivering, Roger realized in surprise.

"Yes. Buffalo Bill got cold, too."

Roger glanced at the pool of sunlight on the dash, but it seemed no weaker than before he had slept. Accommodation of the eye, he thought; the sunlight beating on the ship must be markedly less for them to be losing heat this way.

A lukewarm bath and hot coffee warmed him. He stretched them out, observing that the water purifiers were working well, so that there was plenty of water. There was little to do in space, he had noticed—and that was all done in a crouch.

"The low overhead is getting me down," he said with a smile.

Breakfast was something of an anticlimax to Marta, but she ate dutifully. Roger ate with some appetite, perhaps because of the night's chill. Even now that he was active, the air seemed cool. Chilly, in fact.

With that thought, Roger interrupted breakfast. He had evolved a rule: don't interrupt anything, complete each task thoroughly and as slowly as possible, keeping always busy. Now he stood up still munching and checked the temperature.

It was nineteen degrees Celsius, about sixty-seven Fahrenheit. Just a tad below room temperature, perhaps. As long as they were active, they would notice little, but sitting down, they would slowly chill. Frowning, Roger turned on the car's heaters, set the thermostat for twenty degrees. The electric elements in the ceiling warmed and went off inaudibly but not without effect.

Still, two hours later Roger looked up from the Uncle Wiggily game with Marta, feeling the chill again. The air temperature had fallen back to less than nineteen degrees. The thermostat was still set on twenty. He turned it up and began to prowl the car restlessly in the bent posture forced on him by the low ceiling.

"Is something wrong, Daddy?"

"I don't know, sweetie. I don't understand why it keeps getting so cold."

He poked around his jumble of equipment. The gurgling water purifier could hardly affect the temperature this way. He didn't understand in any case how the air temperature could be so much lower than the temperature of solids within the car. Roger turned to the air purifier.

Unlike the simple ion-exchange system for water, the air purifier was more complex. Fans sucked air in, pulled it through the electro-oxidizer that burned liquid and solid airborne wastes and carbon monoxide. A commercial unit removed carbon dioxide, and a bottle of oxygen replenished that element.

The last stage was half a dozen overworked air fresheners.

He checked the oxygen bottle and found it was nowhere near time to change to a new one. Then, idly, Roger glanced at the reserve air bottles. He had rigged them together so that the emptying of one would open the next.

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They were there on the assumption that his seals would leak a little; the pressure gauge opened whenever air pressure dropped.

Two of the three bottles were empty. No—the second one was almost empty; the pointer on the gauge jiggled down a fraction even as he watched.

"Daddy?"

Roger turned slowly, feeling as though his hair had crisped and turned white. "Yes, dear?" he said huskily.

"Look what I made with only one hand!"

Roger looked and was gently admiring of a card design on the floor. When Marta had gone back to playing with the cards of the Uncle Wiggily game, he considered his equipment. The car was of course not silent; the fans of the air system murmured continuously, and the water recycler gurgled pleasantly. There was even a faint hum from the motors under the deck. The whisper of air leaking through his seals had gone unheard.

They were less than three-quarters of the way to Eureka, and two-thirds of their air was gone. The rate of loss would increase as the seals gave under the erosion. No wonder the air in the aircar was cold.

It seemed to Roger to be suddenly even colder.

It got colder all that day, despite the heaters. Roger ran a new bead of glue over all the exposed seals inside. It didn't seem to help. As the air bottles slowly emptied, Roger tried to cheer his daughter while privately wondering how good his course was. How many million kilometers would they be from Eureka when they had braked down?

He slept fitfully that night. Next day, the last of their trip—he hoped—he was nervous and edgy, and crouched restlessly from place to place, squirting more glue on, combing the space bands for a broadcast from Eureka, checking his equipment. The last air bottle emptied, and the air pressure began to drop. Every so often their ears popped. Marta was solemn and mostly silent. Her back obviously pained her, and he did what he could for her. The wound seemed to be developing an infection, but if his peroxide didn't help, he had nothing that would.

Finally, at midnight on the fourth day, he discontinued acceleration and they floated wearily in their seats.

"Now what do we do?" Marta asked.

"Now we wait," Roger said. "And we send out a signal."

This was something he hadn't planned for. He had expected to come to a stop somewhere near Eureka, to be detected and picked up immediately. He had not considered the necessity for sending out a signal.

After a bit of thought, he said, "Let's play your Crock O'Dyle video. I'll put the recorder microphone into the communicator jack, and the mike next to the video speaker."

After watching the alligator for a while, Marta asked, "Daddy? How long will our air last?"

"I don't know," Roger said honestly. "I hope—a day or so. There's the oxygen bottle."

He brought them the bottle, floundering in free fall, discovering that exertion caused him to gasp uncontrollably for breath. He also fetched food and water and blankets. They bundled themselves, set the bottle between them. Pity

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they had no way of metering the oxygen out.

"Take a breath," he said, and let out a little. Then he took a breath. Long pause, then repeat.

Presently Marta turned her face away from the video. Roger felt the same, and threw a corner of the blanket over its bright window. He looked down at her. His daughter was staring earnestly up at him.

"Yes, Marta?"

"Is this like the tigers?" she asked.

"Sort of," Roger said, startled. He had recited the poem to her once as a partial explanation of why he wanted to go into space. He quoted the first verse for her again, and went on:

"My seeking mind turns outward
To tropic jungles and the night,
Where cold-eyed tigers freely prowl
To hunt and dream and smite.

While I am caged and hungry,
The brightness of my day
Is the thought of distant tigers
In jungles far away."

"I'm not hungry," said Marta after a while.

"Me either," Roger said. Except for air, he thought. Oh God, he thought in agony, what have I done to my daughter? Trying to wipe his eyes unobtrusively, he said, "Marta? Do you wish it didn't happen?"

She thought that over, then leaned against him. "No. But I wish we made it."

Roger hugged her, gently because of her back, and the tears gathered in his eyes. "Me too." Was he justified, he wondered? He had killed his daughter! Was a man justified in taking such risks, just for a chance at a better job, a better future?

After a long time—thoughts came slowly in the cold, airless night—he reluctantly concluded that it had been worth the risk, at least for himself. Society needs scouts, people willing to risk their lives, he thought. Someone needs to remind them that space is big enough for all of us, big enough to give us all a chance.

If we die, that's a private grief. In our way, we are pioneers, even if we're doing it for ourselves. It was Marta's future I was thinking of, too.

I should have come alone. But Marta wanted to come, too. Well, naturally, he thought bleakly. She's my daughter. Pioneers always had a healthy dose of prowling tiger in them.

Patrol Lieutenant Arbatov, commanding the CLPS *Lomonosov*, apologized profusely for the late start till Karl Flachsner grimly asked her if she were rehearsing her speech to the director. The lieutenant was rueful.

"You are correct," she said. "It is the Madame Direktor I fear. Still, what more could I have done? The *Lomonosov* was scheduled for a refit. The air system was all torn down."

Karl and Wilhelm had gotten back to Terra Minor Station just in time to be chewed out by Juana Miranda and sent posthaste to the Moon, to space out in *Lomonosov* to bring back the "derelict" aircar. The clidars of Orbital and Sky Watches had seen nothing fall from it; the director was more than half convinced that Karl and Wilhelm had connived at Roger Li's escape.

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It was just too bad that *Lomonosov* had not been as ready to fly as the director had thought.

Karl sighed. Once only, on a training mission, had he been so far from Earth. This would be the last time, unless his emigration was approved by TLL. That was not likely. In the past four days, seven space-proofed aircars had been flown into deep space. The djinn was out of the bottle.

Now, here they were, less than a quarter of a million kilometers from the car, and over seven million from Eureka.

"That's very bad astrogation, but if he's no astrogator, it's amazing—or incredibly lucky," said Karl.

"ETA in sixty-five minutes at three gravities," said Wilhelm at last, stretching in relief. They piled it on.

"We can take the car bodily into Bay A," said Lieutenant Arbatov, pushing back a strand of blonde hair with a gesture that seemed weary in the three gravities.

Time passed slowly, seeming still slower after their time at high gee. Suddenly *Lomonosov*'s second, Chernenko, said, "Listen to this!" Laughter and music and hokey voices came in on the space band, in a brand of English almost unintelligible to him. Karl looked at the Russians; they couldn't make it out either.

"A distress call?"

"A recording of some kind—"

"It's a video show! My kids watch it—it's called, uh—"

Presently they closed on the aircar. It was floating without power and, ominously, did not answer their hails. Nor had the radar transponder been reactivated.

"Karl, Wilhelm!" Chernenko called, "My spectrographs detect oxygen and nitrogen and water vapor about the car. There will normally be some leakage, and I have no idea of volume, but—"

Karl turned to Wilhelm, who looked back. He hoped that he was not as pale as Wilhelm, but he nodded. "Yes. But—"

Karl had never been so reluctant to do any task as looking into that aircar. The poor little child, he thought. He had seen a recent interview with her mother when it was clear that Li was a deep space vaeback. She had wept on camera.

Wilhelm suited up and went out with one of the crewmen to pull the car in, hooking cables to it and tugging gently. Finally it had cleared the hatch and they repressurized the big hold. As big as Bay A was, the car crammed it.

When the shout of reentering air ceased, Karl opened the door and swam in, followed by Arbatov. Dreading the moment, Karl and the lieutenant approached the jury-rigged space hatch.

Cracking the spill valve in the hatch, he waited a long moment, trying to peer through the window in it. The inside was too dark. He irised the hatch, catching a waft of ripe air improperly recycled.

A wan face with big-seeming eyes peered back at him—Li, floating weakly near the inner door in the home-cobbled airlock, wrapped in a blanket. He inhaled the flat, chill air of the bay gratefully. Behind him, the little girl, her dark hair a cloud around her sunken-cheeked face, looked emptily back at

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Karl, gripping the hose of a space suit air bottle. Her arm was in a sling, just visible under the blanket around her.

"Mr. Li," Karl said formally, containing his relief, his overwhelming, world-moving relief. "Are you and your daughter all right?"

"A little short of breath, and . . . a little lonely," said Li. "It was getting cold." He bore an expression of ultimate loss in his eyes, but he was polite, almost detached.

They had had dreams, even the little child had had dreams, and Karl in his once-proud patrol uniform had shattered them.

It's a trade-off, Karl thought defensively. I'll send you back to Earth and get my emigration the legal way. I hope.

"Mr. Li! Your daughter is hurt," said Lt. Arbatov.

"Yes," Li said quietly. "She was struck by a micrometeorite while we were hiding on top of the aircar."

So that was it, Karl thought.

"That last stretch, with the air running out, was rough." Li closed his eyes wearily. The girl looked feverish and hopeless.

Karl nodded respectfully. They had just lived an epic of courage and resourcefulness. At the end, they could only huddle in the thinning cold and try to keep each other's hearts up.

Even the little girl, Karl thought, could have been under no illusions, no matter how hard she tried to reassure her father. She must have known they were lost and dying.

"We have no doctor," Arbatov was saying, "but there is a medic. We will have her look at the girl—"

"No," said Karl.

The Patrol lieutenant looked at him.

Karl tore his eyes away from the solemn little girl. "That is, your medic may look at her immediately. But we will take no chances. Both she and her father are suffering from exposure. I want them in a hospital immediately. Shape course for Eureka."

She hesitated. "Is this necessary?"

"It would be disastrous if anything were to happen to them, especially to the girl, in our hands. She can't sustain a high-gee trip. And at one gravity, it is four days back to Earth. The patrol could never explain a mishap to her now. Can you imagine what the news media would do to us?"

Arbatov nodded slowly. She was his superior and she was in command of the *Lomonosov*. Still, everyone knew that Karl had the most to lose by the Li incident.

"All right, Karl," she said informally. "It's not quite by the book, but you have a good point about the media. We should be in Eureka in seven or eight hours. Mr. Li, if you will bring your daughter—?"

The little girl insisted on bringing her stuffed toy and an air bottle. While Wilhelm supervised the stowing and securing of the aircar by the crew, Karl accompanied the Lis to see that they were made comfortable for the trip. Karl watched while the medic tended the youngster in the *Lomonosov*'s sickbay.

Wiping her hands, the medic drew him and Roger Li aside. "She has a generalized infection," she said. "I have given her broad-spectrum antibiotic, and I have no real fears for her. I think she lost only a little blood, and the wound, though it looks bad, is not

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deep. Still, you are right to get her to a hospital. I want to do a culture, and I need a lab."

Karl nodded. Good to have support for his decision. "Sit with her, Mr. Li." He felt like adding, "and cheer up," but he didn't feel much like cheering up either. He was in nearly the same spot as Li.

After their hours at three gees, one gravity was like heaven. Karl took a shower and a nap. Afterward he felt refreshed and a little more hopeful, till he returned to sickbay and saw the haggard eyes of Roger Li peering at him.

"Is something wrong, Mr. Li?"

"No. Marta is asleep. I, uh, I could use some food."

Karl cursed, checked himself. "Surely they have fed you!"

"Oh, yes, but it's been hours."

"Come with me." Karl took him to the galley, where they both snacked. Then, since Li was obviously wide awake with tension, Karl suggested they visit the bridge as a diversion.

Roger felt almost as though he was sleep-walking with weariness as they reached the bridge. Lieutenant Arbatov turned to look at them somberly. He waited patiently for a clue to his punishment as an illegal emigrant.

"Congratulations, tovarishch," she said to Roger. "You're quite the hero on Earth and in space."

That was the last thing he expected. He stared at her.

"Oh, yes. Eureka has already gone mad over you; they will greet you with bread and salt. I think they will block your extradition, though it means risking the wrath of Trans Lunar Lines. And seven more aircars have attempted the 'Li maneuver,' as the news media are calling it." She smiled wryly.

"The Patrol must be busy," said Karl Flachsner, looking startled.

"Yes. I fear it must be greatly enlarged. Larger appropriations—we'll need more trained men and women —rotations may be made longer—" She shook her blonde head.

Karl straightened with excitement. "Of course. Yes, of course. Maybe they'll even extend existing rotations."

"Waste of money," said Roger. He was too dazed to be tactful and in too much trouble to bother with being careful. "The Patrol won't last more than a year or so—at least, not fighting back the, uh, the Li maneuver."

Karl Flachsner stared at him; so did Arbatov.

"How do you know?" Karl asked, seriously.

"Too many people on Earth want off," said Roger, swallowing. He was in too deep to worry about stopping now. "Or at least, they want a future. They see no future on Earth. Most of those who make it in the space colonies will someday go home to Earth with their earnings. But many will stay. The Patrol can't stop them all."

Karl Flachsner and Arbatov exchanged glances, seeming equally startled.

"But many will die!" Arbatov said.

Roger closed his eyes, opened them, then looked emptily out into the empty spaces. "Yes," he said. "People always die in frontiers. The Patrol will still be needed, to save lives. And most of the emigrants will survive and prosper."

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There was an awkward silence, broken by message traffic with Eureka. Lieutenant Arbatov excused herself and Roger took the opportunity to break away, back to sickbay. He sat quietly with Marta, too anxious to relax and too tired to think much.

Presently he felt the ship dock. Karl Flachsner looked in on them about that time.

"Do not be so glum, Mr. Li," said Karl. He handed Roger a slip in a sealed envelope. "Message from your wife. And now I'll help you take your daughter out."

Roger pocketed the envelope numbly, nodding, and gently they maneuvered Marta through zero gravity out to the space city. They took a route that had been carefully sealed off and cleared, going to the spin section where the hospital was located. The only locals Roger saw on the way were Eureka security personnel. They had smiles for Roger and Marta, but not for Karl and Wilhelm.

The staff took Marta in hand, leaving Roger in the adjacent waiting room. The Patrol officers started out, but Karl Flachsner turned at the emergency room door.

"Good luck," he said. The Patrol officers retreated hastily through the hostile passages of the space city to their ship, to await orders from Earth.

Roger sat alone, shaking a little in reaction. Suddenly loud, excited voices jolted him. As he looked up, a crowd of people burst into the waiting room. They stopped when they saw him, at first with murmurs, and then abruptly with a roar of cheers and applause. News cameras were aimed at him. He blinked back.

"Mr. Li," said a short, solid man with a dignified air. "I'm Peter Van Zanker, with the Eureka city council. I know you're waiting for news of your daughter, but I want to know that when you're ready, we'll be offering you the key to the city and a real Eureka welcome!" He held out his hand. "You're a hero to us all, Mr. Li. You and your wonderful daughter."

Roger stood up and weakly shook hands with the man, looking at him dubiously. "Uh, I don't know if the Patrol—"

"Never mind the Patrol," the other said sternly. "Eureka will not extradite! And we have job offers for you already. Again, welcome!"

Van Zanker patted him on the arm, posed for the cameras with him, and introduced him to two dozen important spacers, half of whom offered him jobs. Reporters kept shouting questions at him, some of which he managed to answer. Then to Roger's surprise, Van Zanker waved for the crowd to leave.

"All right, let's give him some privacy! Come on, now," he roared. With another round of applause, the visitors backed away, allowing themselves to be bellowed out.

Roger suddenly found himself alone again. The silence rang. He sighed, and finally remembered the sealed envelope. He opened it and read, "Thank God you and Marta are safe. Love to Marta. See you soon. Sheila."

Roger stared at the note. Key to the city. The Li maneuver. No extradition. See you soon.

Stress over financial problems had

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been the real cause of the rift between them. Maybe, just maybe, she'd come—

"Mr. Li, you may come in now," said a nurse.

Roger surprised himself with his smile. He hurried in, saw Marta's dark eyes fixed hopefully on the entrance, and took her hand gently. "Sweetie, we did it," he said, bending low and showing her the message form. "We made it."

"Everything's OK?" she asked anxiously, clinging to his arm, looking at him rather than it. "What was all that shouting?"

"Tigers!" he said, laughing. He hugged her and her loyal buffalo. "We got them all on our side." ■

Special thanks to Poul Anderson, who first mentioned Crock O'Dyle in his story "Un-Man," in the January 1953 *Astounding.*

●War between savage tribes even today is a war of ambush by small groups of men of which each one, at the moment of surprise, chooses not his adversary but his victim and is an assassin.

Ardant du Picq, 1868

●Either there are too few professions conducted honestly, or there are too few honest people in their professions.

Denis Diderot

●Laughter is a creative act that opens up the world of fantasy and amusement; it is also a generous gesture.

Reinhard Trachsler

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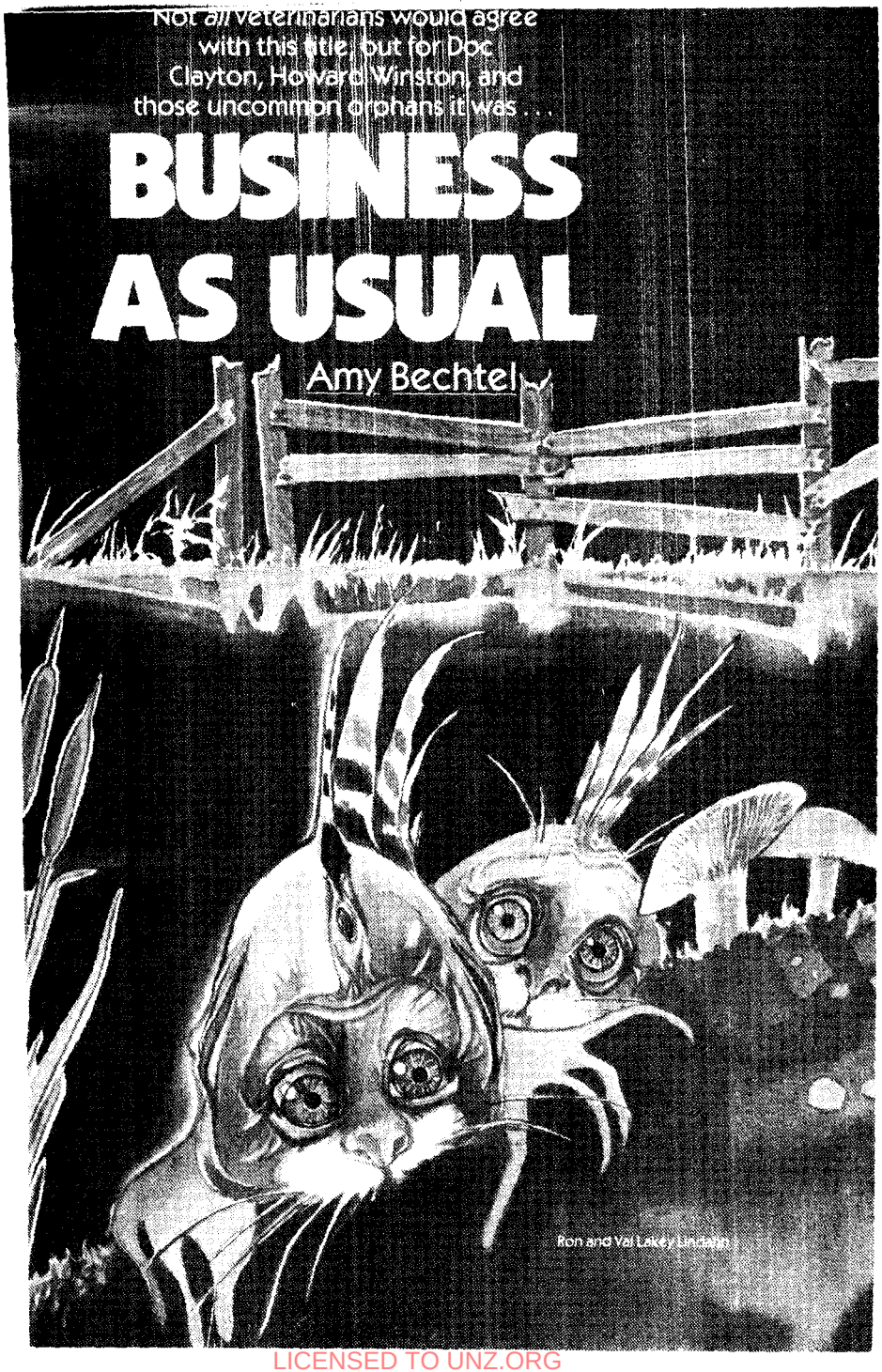
Not *all* veterinarians would agree with this title, but for Doc Clayton, Howard Winston, and those uncommon orphans it was . . .

BUSINESS AS USUAL

Amy Bechtel



Ron and Val Lakey Lindahn

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Howard Winston didn't come into the clinic on Friday. He called instead, and said that one of his sea monsters was missing; could I come out to his place after office hours and help him look for it? Vets get some pretty strange calls. . . . last Christmas Eve I got a call from a young man who wanted to know if I would treat a reindeer; it seemed that one had just fallen off the roof. The only thing was, Howard was serious. I told him yes (trying not to think about the fifty-mile trip or Howard's barely-existent ranch roads), hung up the phone, and went up front to see if there was anyone in the waiting room.

It was a hot and restless morning. It wasn't even nine o'clock yet and my secretary, Lynda, already looked exasperated.

"It's the heat," she said, hanging up her phone with a slam hard enough to knock loose one of the plastic touch-tone buttons. "It brings all the crazies out."

"Crazies?" I said. "What kind of crazies?"

Lynda handed me the appointment book and leaned halfway out of her chair to retrieve the touch-tone button from the floor. "Mrs. Fisher is supposed to be here in five minutes," she said. "She has a pregnant cat that she wants to have spayed. But she wants the kittens left in."

"Say what?"

"You heard me."

"Lynda, why didn't you explain to her that nobody can—"

"I *tried* explaining. She informed me that I was only an ignorant secretary, and that the vet would know exactly how to do it. So I decided to let you handle it."

"Thanks so much."

"You're welcome." The phone rang again and Lynda smoothly picked it up. "Desert Springs Animal Hospital, Lynda speaking," she said. "Yes, Dr. Clayton is in this morning. Yes. He's a very good doctor." There was a long pause while Lynda rolled her eyes at me and listened. Then she said, "You're having a problem with your dog Rosey? I see. Coughing. Yes, I can fit you in today. How about eleven o'clock?"

I was reading the appointment book with a kind of numb horror, and Lynda had to yank it away from me to write the appointment down. "OK, Mrs. Armstrong, we'll see you at—what? Is *that* a problem?" A brief pause, while Lynda scowled and began to erase the entry she'd just made. She said, "Well, when *could* you bring her?"

The morning appointments were nearly filled and aside from the little problem of the pregnant cat that was to be spayed without disturbing the kittens, I would also have the pleasure of seeing a Doberman that had eaten a couch, a cockatoo with diarrhea, a chameleon with skin disease, and a snake with an injured tongue. Lynda had taken the book away from me before I'd had a chance to see the rest. Some things it's better not to know. Why in the world was everyone bringing their most exotic pets to *me?* I love to work on cattle and horses, and dogs and cats are fine, but (though as a vet I should never admit it) snakes give me a sort of a *creepy* feeling. I never used to see anything exotic, except for Howard Winston's turtles and

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hermit crabs. *Howard*, I thought. He was a devoted client. He was probably referring all of his friends to me. Maybe they had some kind of club where they voted on who had the weirdest pet, and printed out lists of unlucky vets who didn't have NO CHAMELEONS signs tacked on their front doors.

Lynda had been silent for quite a while; she was still on the phone but she had gotten that glazed expression which meant Mrs. Armstrong was either explaining why she couldn't make the appointment (in a long and complicated fashion, including the whereabouts of each of the family cars and why it couldn't be used) or was telling stories about her grandchildren. I leaned closer to Lynda, trying to catch a glimpse of the rest of the morning appointments, and Mrs. Armstrong's voice was so loud I could hear her over the phone without even trying.

"You see, Rosey is blind," Mrs. Armstrong said.

Lynda said, "But why can't you just pick her up and put her in the car?"

A brief pause. "But she's *blind*."

"Then don't let her *drive*," Lynda said, finally losing her cool, and I finished reading the appointment book and looked longingly at the back door, wishing for an emergency to come along so I could cancel the morning appointments. A nice calving, maybe. Something I was good at. It's true that I'm better at exotics than I used to be, but the thought of skin disease in chameleons still gives me a pounding headache.

I got through the morning somehow. The woman with the pregnant cat stormed out with her cat tucked protectively under her arm, muttering "abortionist" under her breath as she left. The Doberman that had eaten the couch also tried to eat the cockatoo in the waiting room, but fortunately did not succeed. I managed to treat the chameleon after taking a quick look at some books, but the snake was an unmitigated disaster, made even worse by the fact that his owner, a Ms. Susan Rose, was a woman I would have truly liked to impress. I've a feeling that the look of shocked horror which crossed my face when the snake began to crawl up my sleeve was probably not impressive. Nor did it look good when I dropped my stethoscope on the floor or when I got the hem of my lab coat caught on the doorknob. And when I finally did manage to pry the snake's jaws open and examine its tongue, I discovered that there wasn't anything I needed to do. The injury, a mouse-bite, would heal perfectly well on its own.

"So all you have to do, Ms. Rose, is make certain that little Killer here eats his mice as soon as you give them to him. Otherwise they may just start nibbling on him, ha-ha." I managed to close my mouth on the gory story of a snake I'd once seen that had been completely devoured by the little rodents that were supposed to be breakfast, but it was already too late. Susan Rose was gathering her snake into its carrier, and giving me a frosty look. "His name is *Terminator*," she informed me, and the door shut behind her.

"So how did it go with the snake?" Lynda asked. "And what happened to the hem of your coat?"

"Don't ask," I said.

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"What did you think of Susan Rose? Isn't she nice?"

"Yes," I said. "She's lovely."

"I have an emergency for you," Lynda said, still smiling.

It was just what I'd been asking for all morning, except now it was too late to miss any appointments and I was also going to miss lunch. At least it was a calving; something I was good at. I always did enjoy a nice calving. Hubbington Ranch, where I was calling, was a good forty miles out of town, and I took some pleasure in the fact that I was getting paid for driving down the highway listening to the radio. And it wasn't far from Howard's place, a stroke of good fortune; if I had no more emergencies I could drive on out to his place when I was done. Yes, this was the life. Assuming, of course, that I *did* get paid. With new clients there was no telling.

Hubbington Ranch turned out to have roads almost as bad as Howard's. Nothing was marked, and I made my way to the house on luck and intuition. A small boy was playing alone in the front yard; he ran to the truck when I pulled up, silently pointed the way, and ran off. I hoped that the directions were meant for me, and not for a plumber or a handyman. With some trepidation, I drove on.

It was a long way, and the road was nothing more than a set of tire tracks. I almost turned back—in fact I probably would have if I could have found a place to turn the truck around. But finally, after going up and down over hills, across a dry streambed, and through a canyon, I found my patient. The cow was lying near a muddy, green-edged stock pond, in a small cluster of bushes and scrawny trees. I stared at the cow for a long time before opening the door and slowly getting out of the truck.

At school my professors used to tell some pretty tall tales—like the one about the curmudgeony old rancher who met the vet at the gate with a shotgun when he came to do a government-ordered brucellosis test. Or the one about the man whose cat got a spot of paint on its fur, which he treated himself by dunking the whole cat in a bucket of paint thinner. I always figured these stories were made up or exaggerated. Now I knew better.

I wasn't going to be delivering a calf here today. Someone else had already done it, by the expedient method of tying the cow to a tree and the calf's protruding feet to the bumper of a pickup, and pulling until something gave way.

There were two men sitting in the bed of the pickup. "You the vet?" one of them yelled.

It might have been better to say no, I was the plumber, but I admitted to being the vet.

"About time you got here," the man said. "We need you to fix up our cow."

"I see you've already had a go at delivering the calf yourself."

"That's right. Did a good job, except the fool cow won't get up."

I went over to look at the cow. The bovine has a remarkably high tolerance for pain but this cow had passed the threshold long ago. She looked at me mournfully as I made my examination. Flies were already gathering in thick clouds, and I was surprised there weren't vultures.

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"I'm afraid there's nothing I can do now," I said. "You've broken the pelvis and torn the uterus apart, and there are probably other internal injuries. You can't just yank a calf out of a cow by sheer force, you know. If you had called me sooner . . . " I went to check the calf; and took the ropes off her feet. Both forelegs were broken, but otherwise she was relatively intact.

"Told you vets were no good," the first man said to the second. "Waste of time and money."

The second man said, to me, "Money? We're sure as hell not paying good money for you to come out here and do nothing."

"I won't charge anything," I said. It hurt me to say that; I really wanted to charge triple and take them to court. "As long as you let me put this cow down, and let me take the calf."

"You want the crippled thing, you can have it," the first man said. "We'd just better not be getting any bill from you."

They drove off in a cloud of dust, and everything seemed suddenly, strangely peaceful. A soft breeze rippled the water in the stock pond and set the trees to waving overhead. Flies hummed and buzzed, and the engine of my truck made muttering noises as it cooled. The cow put her head down and groaned. Numbly I opened the back of my truck, got out the Sleep-Away, and drew up a syringe full.

"That's it old girl," I said, kneeling by her neck. "This'll help. Promise." I put my thumb to the jugular groove, raised the vein, and injected the Sleep-Away. The cow sighed, relaxed, and slipped quietly into death.

I got up stiffly and went to pick up the calf. Just what I needed, a newborn calf. I'd need help to cast the legs properly; maybe I could get Howard to help when I went out to—

There was a large *splash* from the direction of the stock pond, and I looked up, startled, to see a spume of muddy water rise like a fountain in the center of the pond. I almost dropped the calf. Then an inquisitive bewhiskered little face broke the water, and a creature splashed up to the edge of the pond, reaching for the bank with the tentacles on the ends of its fins.

There was a sea monster in Hubbington's stock pond.

It was very crowded in the truck on the way to Howard's place. The vet box took up the whole bed of the pickup, so the sea monster and the calf both rode up in the cab with me. I put the sea monster on the floorboards, hoping it would be less visible there, and laid the calf on a towel across the seat, trying to fit it so the hastily splinted forelegs wouldn't tangle with the gearshift. As we drove past the house I felt myself cringing, afraid that someone would run out with a shotgun and demand that I return the sea monster. A whiskery wrinkled face peered over the edge of the seat and I pushed it back down with a gasp.

The two men were standing out in the yard, watching me go, but they did not seem inclined to stop me. I would have to make sure that their file was *very* carefully marked "No further service (ever)."

Before I reached the main road I had to stop and fill a bucket from the tank

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in the back of my truck, and slosh water over the drying sea monster. It sprayed a little water from its blowhole, happily, and the calf lifted its head indignantly at the shower. Two sloshes later I reached the main road, and by this time I figured that I would be able to grow mushrooms on the floorboards. Even so, the monster was drying out as fast as I could dump water over it, and it was far too big to fit inside the bucket. The next time I stopped I pulled the towel out from under the calf and draped it over the monster, then drenched the towel. Maybe that would keep the monster moist for a little bit longer.

As soon as I was back on the road the sea monster made a few unhappy clicking noises and shoved off the towel with its fins. So much for that idea. I decided that my best bet was to drive as fast as I could to Howard's, to the pool that was the sea monster's home. I was only a couple of miles from Howard's turnoff when I saw the flashing lights in the mirror, and heard the siren.

For an instant I had the crazy notion of jamming down on the accelerator and taking off, but once they caught me they would be sure to search the truck. I took my foot off the gas, touched the brake, and with one hand draped the towel back over the monster. The little creature looked up at me innocently, eyes and whiskers peeking out from under the damp towel, everything in its attitude and expression suggesting that it trusted me implicitly. The siren was much louder now, the flashing lights brilliant in the rearview mirror. I slowed the truck a little more and moved toward the shoulder.

"You've got to understand, little guy," I whispered. "You've just *got* to, see?" It gazed up at me, blinking, and put a curious fin out from under the towel. "No," I said. "*No*, dammit; you've got to stay hidden. Get *down*." Holding the wheel with one hand I grasped the monster's fin and gave it a firm push down. The tentacles on the little creature's fin wrapped themselves suddenly, tightly, around my fingers, and it let out a stream of surprised-sounding clicks. I pulled my hand free, pushed the monster's head down, and covered it entirely with the towel, upending the bucket on top of it for a better effect. Then I couldn't delay any longer; I drove the truck onto the shoulder, and stopped. The calf's legs bumped against the gearshift and it bawled mournfully. I pushed open the door of the truck and waited for the cop to approach, trying to look harassed and rushed rather than just plain frightened. I closed my eyes for a second, hoping: maybe it would be Darrell Jones. Last week I'd spent half the night treating his horse for a nasty case of colic; he'd certainly let me off with a wink and a warning now.

"Well, well. If it isn't Doc Clayton. What's the emergency this time?"

It wasn't Darrell Jones. It was Roger Whitman, who'd stopped me for doing ninety about a month ago. If only I hadn't fed him that story about being on the way to an emergency. He'd quietly followed me all the way to the farm, and had discovered that I'd actually been on my way to tube-worm a bunch of perfectly healthy horses. He was never going to forgive me for that.

"Hello, officer," I said, feeling sick. If I calmly accepted a ticket, he'd know there was something up. I said, "I really

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do have an emergency this time. A little calf. She's really been smashed up and I need to get her in to surgery as fast as I can."

I held my breath as Whitman peered into the truck and examined the calf. I could hear the calf shifting about on the seat, splinted legs bumping against the dashboard. The lumpy towel on the floorboards wiggled and I froze, cringing at the thought that a face or a fin might suddenly appear from underneath it. How would I explain the monster? Could I get away with making up a name for it and pretending that it was something ordinary? No, no; the monster was far too peculiar; even Whitman would be able to tell that nothing like it had ever been seen before. Word would spread fast, and soon there would be no safe place for a monster to live.

"Well," Whitman said, looking at the calf. "The poor little thing."

"Is it all right if I drive on, then, officer?"

"This time you can," Whitman said darkly. "You'd better not be telling me a tall tale. And slow down, or you're going to be smashed up and on the way to the hospital yourself."

"Yes. Thank you. Of course."

I drove on, keeping the speedometer at sixty, very much aware that Whitman's car was following, making sure that I did indeed return to the clinic. Ten miles later the towel on the floorboards still hadn't moved, and I started to get worried again: was there something wrong with the monster? Carefully I leaned over and pulled back a corner of the towel. The monster looked up at me solemnly, not moving; I gave it what I hoped was a reassuring touch and covered it again. The towel wasn't wet any more, the bucket was empty, and I couldn't very well stop at the side of the road to fill the bucket from the truck's water tank. I let the speedometer creep up to sixty-two, and drove on.

When I pulled into the clinic parking lot the towel was bone dry and the monster hadn't so much as moved a fin for fifteen miles. I scrambled out, hauling the calf with me, and waved at Whitman as he cruised by. Didn't he have anything better to do? I staggered inside with the calf, dumped it unceremoniously in Lynda's arms, and raced back to the truck. When I dragged the sea monster out, it didn't move. Its skin was dry and leathery, and the tentacles on its fins were limp. I wrapped it in the towel and made a mad dash for the clinic. Lynda was sitting on the floor with the calf's head in her lap; she watched as I dumped the sea monster, towel and all, into the tub and turned the water on full blast. Hastily I stoppered the tub, and as the water level rose, I gently supported the monster so that its blowhole remained out of the water while the rest of its body was immersed. I was scared, let me tell you. I thought I'd killed the little creature. But after a couple of minutes its fins began to move and its eyes began to blink; it looked around with what appeared to be bewilderment. A few minutes later it was able to keep itself afloat, and I let go of the monster long enough to turn off the water, which was about to overflow from the tub. When the monster's bewildered expression turned to one of curiosity, I knew it was going to be all right.

"What do you want me to do with

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the calf?'' Lynda said mildly. I'd completely forgotten about her. I'd forgotten about the calf, too.

''Er, I'm going to need some help with it. In a minute. I have to replace those splints with some proper casts.''

''I'll get the cast material out, then,'' she said. As she passed by me on her way to the bandage cabinet, she took a closer look at the monster and said, ''That must be one of Howard's pets. I've never seen anything like it. What is it?''

It was a little late to keep it secret, and if I couldn't trust Lynda who could I trust? While we were putting casts on the calf's legs, I told her the story of Nessie, Howard's enormous sea monster, who had lived in a deep pool on a remote part of Howard's property. I told her how Nessie had grown ill and had died one moonlit night, leaving ten tiny little monsters orphaned in Howard's care. Lynda looked awestruck by the time I had finished the story. She had always been fond of Howard, and when she found out that he had bottle-fed ten orphans night and day for weeks, the fondness turned to adoration.

''What a wonderful thing for him to do,'' she said.

''Well, you know how he is about orphans. He'll take care of any creature that's been abandoned.'' I finished the second cast, stripped off my gloves, and, looking at the calf, realized what I'd just said.

''You wouldn't,'' Lynda said.

''Oh yes I would. He owes me for finding his monster.''

She thought about it for a minute, then said, ''You'll need some help getting them out to Howard's place.''

I drew blood from the monster before we left. Telling Lynda the story of Nessie and her babies had reminded me of the uncomfortable fact that Nessie's death, and that of her mate, remained unexplained. The necropsy I'd done on Nessie had been nondiagnostic, to say the least, and I had to assume that the little monsters were still at risk. I'd taken blood samples and done physicals on all ten babies every month, so as to compile a table of normal values. Now I had a sample from a stressed, dehydrated monster to compare to the normals. It still didn't seem like much. So far, the best treatment I could offer the monsters consisted of crossing my fingers and hoping desperately that none of them ever got sick. If that failed, I would have to enter the uncertain realm of improvisational medicine, extrapolating treatments and doses from the closest available species and hoping that nothing I did would have any lethal side effects.

It was really much more fun to do a nice calving.

On the way to Howard's, the monster (which Lynda had named Curious) splashed happily in a washtub we'd put on the floorboards under Lynda's feet, and Lynda carried the calf sprawled across her lap. I was careful to stay close to the speed limit, and it was near dusk when we finally joined Howard on the distant corner of the ranch where his little monsters lived. Howard had the dazed look of a man who had suddenly taken on responsibility for ten active, curious, and fearless toddlers. He was

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placid and gentle by nature, but the growing monsters were taking their toll on him.

"It was *where?*" he asked.

"Hubbington's stock pond," I said.

"Hubbington's . . . oh dear, oh dear."

Carefully he placed the little sea monster back in the pool with the others, who crowded round it eagerly, looking for all the world as if they were listening to it tell the story of its adventures. Howard stepped back from the edge of the pool, water dripping unnoticed from his shirt sleeves.

"Fences," he muttered. "No, fences won't work; not at all. They'll just go down deep, and who knows where they'll go to, where they'll end up? There's a whole network of underwater passages down there. It's bad enough they can get to Hubbington's stock pond. They could go farther! Oh, the places they could end up. Water purification plants. The Great Lakes. Loch Ness."

"I don't think the water table reaches all the way to Loch Ness," I said.

Howard looked at me dolefully and said, "It might. How can we keep them from going so far? It's so dangerous. If they were discovered, anything might happen. But I don't know how to keep them here."

"If you can't make them stay," Lynda said, "then you've got to explain it to them. You've got to tell them."

"But how can I tell them that?" Howard said helplessly. "If their mother was here she'd know how to tell them. But I just don't know *how*."

He looked away. Howard had loved Nessie, and he had actually been able to communicate with her on a limited level . . . a distinctive pattern of slaps on the surface of the water to call her out of the depths, a touch of his hand to her fin to give comfort and reassurance. She had known where her safe places were. But she had died before she could pass that knowledge on to the little ones.

"They make clicking noises," Howard said, "like dolphins. I'm sure there's meaning in those sounds. But so far there's been almost no progress in communicating with dolphins, even after years of trying. I don't think we're going to succeed overnight with the monsters."

We spent hours sitting at the edge of the pool, watching by moonlight as the monsters played and splashed in the water, wondering how in the world we were going to keep all ten of them alive and safe and hidden in this world. We had to find some way to talk to them, to teach them what monsters needed to know, but how could I expect to communicate with them when I didn't even know what kind of diseases they got? The only communication we achieved that night was between Howard and Lynda, who moved closer and closer to each other as the night wore on, and by midnight sat leaning against each other, holding hands and taking turns bottle-feeding the calf.

When I left, Lynda didn't come with me. "It's Saturday," she said, "so I don't have to come to work in the morning. And Howard will need someone to spell him feeding the calf tonight." I drove home alone, dead tired, yawning and trying not to drive over the edge of the cliff on Howard's narrow and bumpy

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ranch roads. At least I wasn't on call tonight, or tomorrow. I was going to have a *whole day* off. I planned to spend at least the first half of it in bed, asleep.

The phone rang promptly at seven in the morning. I hit the clock twice before realizing that it was the phone, and then tried to ignore it, but it kept ringing until I finally gave up and answered it. It was Howard.

"You've got to come out here," he said.

"What? Why?"

"It's the monsters," he said, and I woke up enough to realize that he sounded desperately worried.

"What's wrong with them?"

"They're gone."

"What, all of them?"

"Yes. All of them."

"Are you sure? Maybe they're just down deep somewhere, catching fish or something."

"No. They've been gone for over an hour, and they never stay down that long. And earlier this morning they were all in a circle around Curious, touching its fins and clicking, like they were talking about something. I think they decided to go back and see the place that Curious found."

I looked at my watch again as my last hope of going back to sleep disappeared without a trace. This was what came of agreeing to work on exotic species.

I was going to have to go back to Hubbington Ranch.

I met Lynda and Howard at the turnoff, and after switching to Howard's truck (which had lots more interior room) I drove fearfully onto Hubbington's place, wishing I knew a back way to the stock pond that didn't go near the house. When we did pass the house, moving at a crawl so as not to be noisy or to raise a dust trail, I felt like every window in the house was watching us. At least the little boy wasn't out in the yard today.

I took a sharp turn to the right, remembering the boy's directions, and the truck lurched, rocking onto the faint set of tire tracks that led deep into Hubbington's property. I watched the house in the rearview mirror; the windows were staring blankly now, and nothing stirred. Then the truck topped a rise and started down into the small canyon, and the house vanished from sight. I remembered to breathe, then, and heard a soft sigh of relief from Lynda.

We crept through the canyon, the truck's engine barely ticking over as we moved. It took forever and I couldn't help being afraid that I'd somehow gotten onto the wrong road; at this slow speed the road, such as it was, did not even seem familiar. But finally I saw the clumps of trees and bushes and knew the stock pond was near. The truck ground to a halt next to the carcass of the cow, and we got out quietly, careful not to slam doors.

There wasn't much left of the cow; it looked as if a pack of coyotes had already been at the body. I looked down at it for a moment; it was a testimony to the way the Hubbingtons would treat any sort of creature which crossed their paths.

"That's not . . . is it?" Howard looked pale, and I realized that he thought this carcass might be one of his

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monsters.

"No. Cow bones," I said, and made my way through the bushes to the edge of the stock pond. Howard and Lynda followed. We found the stock pond silent and still. All we could hear was the buzz of flies as they zipped back and forth between the dead cow and the green scum at the edge of the pond.

"They're not here," Lynda said softly. "What now?"

"We get out of here," I answered.

"Wait," Howard said. "Look."

Down in the bushes by the edge of the pond a small boy sat crouched, gazing raptly at the water, oblivious to our presence. I recognized the little boy who had silently given me directions the first time I'd come here. As we watched, the water began to ripple, ever so slightly, and Curious emerged. Curious put a fin onto the bank and the boy, wide-eyed, reached out to touch it. Fin and hand came together in a gentle clasp, and the little monster's tentacles wrapped through the boy's fingers and around his wrist. The water began to ripple again, and other monsters cautiously lifted their heads and spouted water. The boy smiled, looking for an instant like a different child. Then his gaze wandered across the water and fastened on us.

The boy stiffened, his face filled with terror, his hand still clutching Curious's fin. The monsters reacted even more violently. Curious flung itself away from the boy, splashing heavily into the center of the pond, and all the other monsters clicked wildly and dove. After a frozen instant, the boy turned and ran, vanishing into the screen of bushes. The pond was quiet and still again, save for the drone of flies and the soft whisper of trees.

"Something scared them," Howard said, hopeful. "Maybe they went back home."

A fin broke the surface of the water, followed by a set of whiskers and a pair of inquisitive eyes. "No such luck," Lynda said. "They're not that scared."

One by one the other monsters cautiously began to appear, clicking to each other. The sight of us seemed to completely reassure them, and they began to play. Howard knelt by the muddy bank and began to lightly splash the water, in a familiar pattern. "Sometimes they'll come to this," he said, but the monsters weren't paying attention; they were busy having a water fight. Suddenly the idea of catching all the monsters and smuggling them off the ranch seemed ludicrous. The monsters were in high spirits and it might take us half the day just to get them out of the water.

"Look," Lynda whispered.

There was a cloud of dust on the horizon, coming closer and closer with frightening speed. Howard scrambled to his feet, horror building in his face. "It's the Hubbingtons," he said. "We're trespassing, and they'll be armed. Have you ever seen their gun collection? What'll we do?"

Howard and Lynda were both looking at me. I glanced at the approaching dust cloud, then at the pondful of happy splashing monsters. As I watched them swim I saw, for an instant, an overlaid image of the pond still and silent, the boy running off into the bushes. Something had frightened the monsters at the same moment the boy had looked up and had seen us. The boy had been

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afraid of us, but the monsters knew us, they knew Howard's truck; they'd had no reason to be afraid. Except—

Curious swam toward me. I looked into its eyes and saw it lying on the floorboards of my truck, looking up at me with trust. It had refused to stay hidden until I was in a panic, until I had frantically grabbed it and thrust it down under the towel at the very moment the police lights were flickering in all the rearview mirrors.

I plunged into the water and grabbed Curious as it came toward me. Holding it by the fins, I turned and looked at the approaching truck, enveloped in its dust cloud, ominous and terrifying. As the truck came closer, Curious squeaked in shock and tried to pull away, but I held on. The other monsters hovered near, fins touching, all peering nearsightedly in the direction of the road. The fear between us became palpable . . . it was a dog huddled in the back corner of a cage, shivering; it was Nessie lying dead and bloated on top of a flatbed truck; it was a skeleton of old bones, rotten and green, stirring in a dark forgotten current. It was a flashing red light reflected in a rearview mirror. It was a little monster with a gunshot wound, bleeding from mouth and blowhole as it gasped out the last of its life.

And then the monsters were gone, headed home as if all those fears and nightmares were chasing them, and I was alone, standing in greenish water up to my knees, while Hubbington's beat-up pickup screeched to a halt nearby and the two men, shotguns in hand, leaped out.

I sloshed my way out of the pond and headed for Howard's truck, Howard and Lynda following close behind. I didn't give the Hubbingtons a chance to start in.

"Just came back to check on the cow," I said, gesturing at the jumble of bones. "Don't worry. It's a routine visit, so you won't be charged a fee."

When we got into the truck and sped off, they were still staring at the pile of bones that had been my patient, as if trying to figure out why I had needed to recheck it.

When we got back to Howard's place, the monsters were all there, waiting, looking a trifle subdued. Howard got out his scuba gear and spent the rest of the day in the water with them, finding the underwater passageways that tunneled beneath the mountains, carefully clasping the creatures' fins and conveying all the fear he felt at the thought of them traveling those paths, letting them know how dark and dangerous it might be for them there. Lynda and I waited on the bank, watching and waiting.

"How do you suppose they understand?" Lynda asked.

"I think it's much the same way a dog knows if you're frightened of it. Strong emotions trigger chemical changes in the body. It looked like the monsters can detect these changes, and they've learned what some of them mean. Like fear."

"Then they could understand other emotions too. Love, affection."

"I think they could. If the feelings were strong enough."

Lynda looked out at the pool, thoughtful. "If they can already understand this much," she said, "they can probably learn to understand much

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more."

"Probably."

"I'll have to work on that."

"It won't be easy."

"I'm a secretary," Lynda said. "*Your* secretary. By now I really ought to be able to communicate with anything."

Lynda didn't come home with me that night, either.

On Monday morning Lynda was unbearably bright and cheerful, making me feel even more tired than I was. I had been coping with sea monsters all weekend and it seemed only fair that I should be able to have at least one morning with nothing but ordinary animals to see, but one of my first appointments was an anorexic macaw. I didn't relish the thought of examining a razor-beaked, gigantic bird which was prone to a myriad of exotic illnesses. When I saw it listed in the appointment book (second in line) I figured that this was going to be another of those excruciating days. I was sure of it when I called my first patient into the exam room.

Tiny weighed at least a hundred pounds and looked like a cross between a St. Bernard and a pit bull. His owner, Mr. Patterson, was a big man, but the dog was clearly in charge. When he heard his name called, he took one look at me and headed for the front window, dragging Mr. Patterson after him at the end of the leash. Tiny took a running leap at the plate glass but Mr. Patterson made a heroic effort and pulled him off just in time to keep the dog from going through the window. Then he dragged Tiny into the exam room and shut the door on him. Tiny was not at all pleased to find himself shut in a small room with a vet. He began to growl, ominously, curling his lip and baring his fangs.

"And what can I do for you today?" I asked Mr. Patterson, hoping Tiny could not pick up the fear I was feeling quite as well as a sea monster could. I glanced at the file for the presenting complaint, then looked again, disbelieving. Mr. Patterson smiled and said, "I need you to have a look at his teeth."

After I had bandaged my wrist and changed into a lab coat that didn't have blood on it, I went back to the waiting room to call in the next client. It was the lady with the macaw. I decided to keep the bandage materials out; after a run in with that beak I might be needing them again. I was getting ready to call in the macaw when I saw Susan Rose sitting on a bench, an open magazine and a kitten in her lap.

"Susan *Rose* is here?" I whispered to Lynda. "To see *me?*"

"Of course," Lynda said. "She commented on how well you treated her snake. It completely recovered on its own, just as you said it would. So she wants you to have a look at her kitten today."

Another chance with Susan Rose! Perhaps I had not made such a bad impression on her after all. Perhaps this time, after all the practice I'd had communicating with sea monsters, I'd be able to tell her what I really meant to say. Happily I called in the macaw. It was going to be a good day after all. ■

Editor's Note: Doc Clayton, Howard, and his monsters, first appeared in "Little Monsters," in our November 1989 issue.

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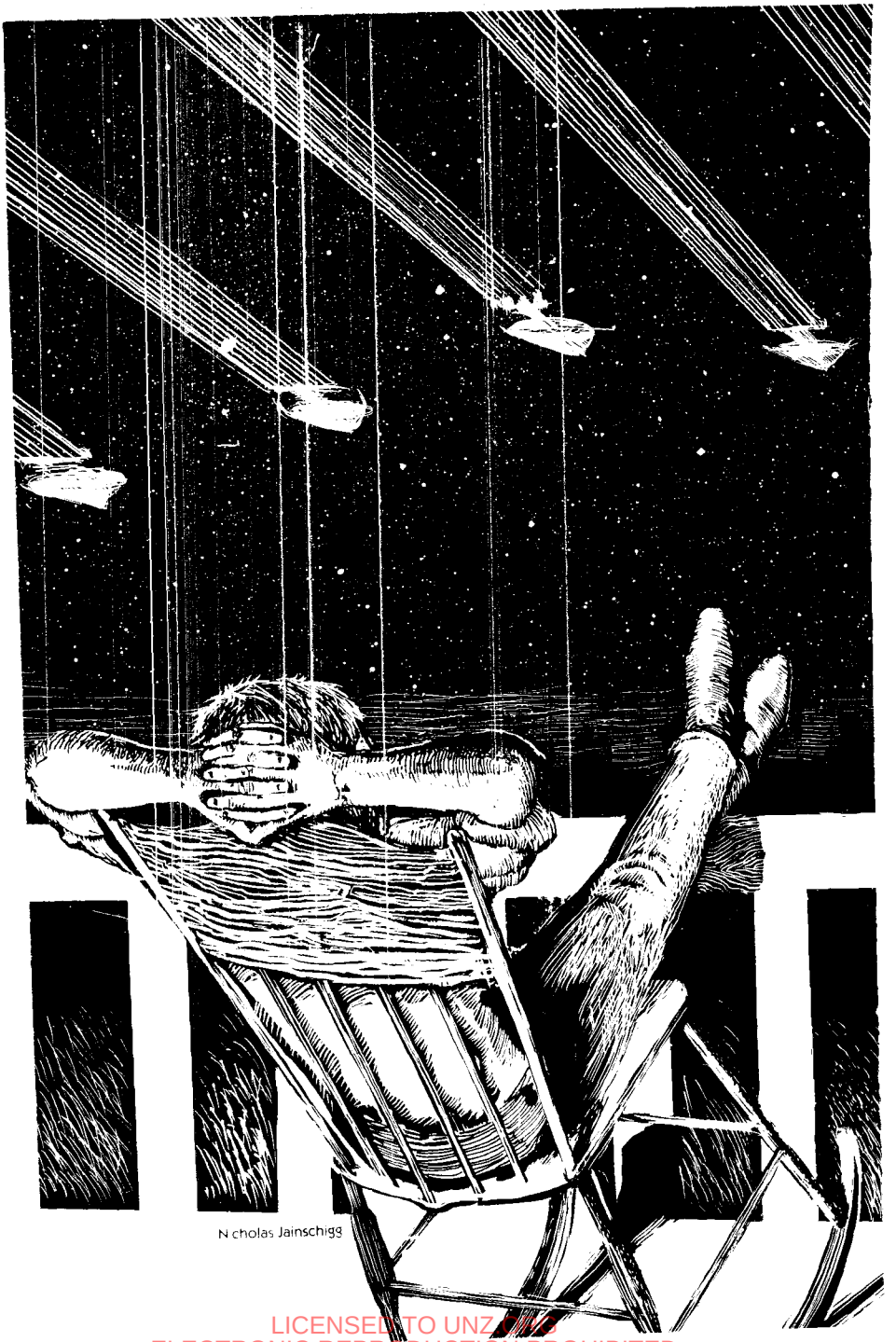

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ASGARD—Second planet of Mu Cassiopeiae, a G5 star in the Perseus Sector, 7.7 parsecs from Sol.

Radius:	4812 km
Day:	30 hr 13 min 12 sec
Year:	215.626 standard days 171.253 Asgard days
Axial Tilt:	21°
Surface Gravity:	.91G
Atmosphere:	28% 0_2 70% N_2 2% other
Mean Pressure:	1110 millibars at sea level
Distance from Primary:	.73 A.U.

Planetological Description: An Earth-type planet with 30% land, 70% ocean, currently in advanced stages of continental glaciation with ice cover extending as far south as the 40th parallel.

Scout team landed in Year 32 of New Era. Breakthrough colony followed in Year 87. . . .

—from *The Official Scout Service Handbook of the Stars and Planets*

ONE

Guy Stanger leaned back so he could get a better look at the stars. Rudy had set long ago. The clear night revealed the Milky Way in all its glory, crossing the sky in a broad band from east to west with the thicket of dust and star clouds that marked the galactic core centered halfway up from the southern horizon.

He sat on the porch of the main lodge of what had once been the Glacier Valley Scout Post and was now the center of Asgard University. Emily Baxter sat beside him, holding his hand. She was a member of den Middlesex, the college den, which had brought the university with it from Earth.

"You see the dark spot in the middle? That's the Coal Sack. It's just a big old cloud of dust hanging in front of everything else."

"Where's Sol?" asked Emily.

"Right beside it. A lot closer, though. See the bright cross beside the Coal Sack—the Southern Cross? Just to the left of it is a little triangle. The star on top is Sol, the one beneath it is Alpha Centauri. Off to the right there is Sirius and that really bright one up there away from the Milky Way is Eta Cassiopeiae—only six light-years away."

"Yuck," said Emily.

"Yuck?"

"That's what I said. If it weren't for Eta Cass being so close, the Kolbergs would have left us alone."

"The fault, dear Caesar, lies not within our stars, but in ourselves," Guy said.

"Says who?"

"Brutus, I think."

"I'm cold. Let's go inside and find something to eat."

"Sounds like a good idea to me."

Emily and her family were among the lucky few who had been quartered here in the main building. The rest of the den was distributed among a dozen dormitories that offered fewer amenities and a stronger taste of the old scout life. The scouts had watched over Asgard for more than half a century, waiting for the arrival of the breakthrough colony.

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Guy, being a scout himself, had no pity for either group. Until last year, when the colonists landed, he had been quite content with the post's spartan environment.

But he did have a craving for leftover soup—although it lacked the thick chunks of fuzzasaur that he always included in his recipes. Emily was a vegetarian and refused to make the soup the way he liked it. Even so, it still was better than the pasty stuff that comprised the colonists' rations.

She removed the pot from the fridge and set it on the power range, stirring as it came to a boil.

"I don't like to see you worrying about the Kolbergs all the time," Emily said after a while.

"Someone has to do it."

"I suppose so. Mother doesn't have the heart for it anymore. She spends all her time brooding or grieving over Ray. But I don't know why you have to take over the job. You're acting more and more like her every day."

"That's not fair," Guy protested.

She turned her back on him to tend to the soup, filling two bowls and setting the pot on the counter. She put the bowls on the table and went hunting for spoons as it cooled, thin tendrils of vapor rising into the air. She found them and returned to sit beside Guy at the table. "What's bothering you about them now?" she asked.

"Why would anyone cross six years of space, risk their lives and those of their loved ones, just to leave one colony behind for another?"

"Money? Power?"

"The Kolbergs had those back at Eta Cass. They still do. Why did they leave it all behind?"

"The consensus around here is that the other colonists on Tikarahisat didn't like them," Emily said, before blowing on a spoonful of hot broth. "Maybe they got into trouble. Goodness knows they aren't popular here on Asgard."

"That's speculation. Everything we've been able to learn—and there isn't much, says that they left Tik voluntarily. I can't help feeling that there's something more to this than we know."

"Now who's speculating?"

"I can't help it. Things just don't add up. I just wish I knew what they were trying to do," he said. "I can't stand waiting around to see what's going to happen. By the time we find out, it may be too late."

"What can you do about it?"

"I can send your little brother out on another run. He likes that kind of thing. Have him start counting dens to see who's on their side, who's on our side and who's in the middle—especially who's in the middle. With the constitutional convention coming up, who knows what could happen."

"I suppose so," Emily said.

"And you could help too."

Her eyes widened. "And what have you got in mind for me, Guy Stanger? I'm not about to go spying on Kolbergs for you."

"I was thinking about something a little closer to home. You're a socio-economics student. You've got access to the colonial reports. Start checking the numbers. Look for something unusual. Maybe we can correlate some differences between the dens who are

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working with the Kolbergs and the rest of us."

"I don't know, Guy. It all sounds so . . . so . . ."

"So paranoid. That's the word you're looking for, isn't it?"

"I was going to say suspicious. Don't you think you're blowing things a little out of proportion?"

"No, I don't. Neither does your mother."

"I'm not sure I trust Mother all that much."

"Then trust me. I've spoken to some of the Kolbergs. These are not nice people we're dealing with here."

"I know," she said with a pained expression. "I didn't say I wouldn't help. I just don't know what good it'll do."

"It'll make me feel better, for one thing. And you might come up with something."

"I've got other ways of making you feel better," she suggested with a seductive smile. "Do you want to see?"

Guy smiled and stroked her face with the back of his hand. "Again?"

"What's the matter, am I too much for you?" she asked as she picked the soup bowls up and put them in the sink. "Tell me something, though, while Joey is out spying on the Kolbergs and I'm here crunching numbers, what are you going to do?"

"I'm going to stay home and worry —what else."

She flipped her head back in a laugh that summed up all her feelings about Guy's division of labor, then ran quickly down the hall as the young scout took after her.

* * *

For Lin Palmer the split between delegates from the dens linked to the Kolbergs and those who opposed them, began a short time after he boarded the bus for Center Township.

Half the seats were full when he climbed on at the Aroostook village center and took a seat near the middle. Two knots of passengers, one in the front and one in the back, were locked together in hushed conversations broken occasionally by laughter or a loud remark. He knew that today's run would be carrying other delegates, but he couldn't overhear enough from either group to tell who was who or what they were talking about. So he rode in silence for a half an hour.

Then the bus pulled into the village center at Jasper Township and picked up two passengers. Lin recognized one of them—Hans Beck.

The sight of the man sent a chill up his spine.

During the hard Asgard winter, when Lin's future looked bleak, Beck had visited his farm, accompanied by one of the Kolberg associates. The two men had tried to get Lin to sign a labor-bond contract, offering him capital assistance in return for an open-ended commitment to work for them whenever they needed him. If things hadn't turned around for Lin when the weather forecasts began, he might have been tempted to sign it. But he thanked his lucky stars that he did not.

He watched Beck closely and felt his face flush when the man looked straight at him. There was a moment of hesitation, but no response from the Jasper den leader, no sign of mutual recognition. Oh well, Beck must have talked

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to dozens of farmers, while Lin had met only one surly manipulator.

But Beck did seem to recognize other passengers on the bus, greeting the cluster of men in the first few rows of seats and taking a place among them. They continued their discreet conversation as the bus pulled out.

Lin looked towards the back of the bus and examined that group more closely. If the bunch in the front were friendly with Beck, then they must be Kolberg supporters. That meant the ones in the back. . . .

"On your way to the convention?" asked a woman with an odd accent, clipped and British, Lin thought, but he wasn't sure.

"Yes," he said. "You too?"

"Gladly. Betty Montgomery, den Cornwall." She offered her hand over the back of the seat, and Lin shook it.

"Lin Palmer, den Aroostook."

"That's Maine, isn't it? I'm from the south of England myself. Long way from home, what? George, my husband, he's the farmer. He figured I'd be more useful talking everyone's ear off at Center than I would be his. I guess the rest of the den felt the same, because here I am."

"They picked me because I've got an extra hand back on my farm," Lin said. "And because they trust me not to let the Kolbergs pull anything tricky."

"Pardon my French, but damn those K's and their scheming," Betty said. "That's the same reason my den sent me. To stop them from perverting this business with their plots and plans and labor bonds and everything else. I don't know how we're going to do it. They're organized, and we're just offended."

"Maybe we can help," suggested a third voice—one of the group at the rear of the bus. "Ed Findlay, den Lincoln. Not everyone on this bus is a delegate, but nearly all of us are. I don't suppose it's too early for coalition building, do you?"

Lin and Betty smiled and joined the rest of the cell. By the time they reached Center Township, they had organized a caucus of five dens ready to block the influence of the Kolbergs at the convention. Not a bad morning's work, Lin realized. But it was only a beginning. The real fight would come later. . . .

At three stories, the Hotel Asgard was the tallest building in Center Township—although a few of the cabins at Highland Post beat it out for the planetary title. Lin was given a room on the top floor, two flights up, that he would share with Ed Findlay. He unpacked, called home and spoke for a long time with his wife. This was the first time they'd been apart since before leaving Earth many months ago. The precise number was lost to him after the change in calendars. More than a year, Asgard time, or seven months, old Earth time. Their baby wasn't due until November, but she was still nervous. Even with a hired hand around to do the work, it was hard on her.

The convention would not start for another day, so Lin had time to take a walking tour of Center Town. With a population of ten thousand, it was more than a village, sprawling over nine square kilometers.

There were hectares of tents and houses and shops and workyards and equipment. Warehouses filled with rations and supplies lined the nearby land-

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ing strip. The permanent residents of Center included two management dens, two health dens, one special services den, a food processing den, and a service den. The bulk of the land in the township remained empty and uncultivated. No farmers were assigned here, and the territory was left vacant for expansion of the urban center and adjoining agricultural dens—and for the fuzzasaur crowds that had begun their annual spring migration into South Valley.

Lin had heard a story about this year's migration—that it was being regulated at a pass in the southern hills to keep the numbers down. Good thing, too. He didn't want the grazers to start working on his corn, and he didn't think a scarecrow would keep the fur-covered saurians out of his fields.

The streets of the township were thick with traffic—both vehicular and pedestrian. The number of people here was overwhelming at first. Lin had spent the winter in relative isolation, visiting Aroostook village periodically to pick up supplies. It wasn't the same as Caribou or Houlton back home, but Center was clearly the closest Asgard came to a thriving metropolis. And it was as close to one as Lin wanted to come.

When the colonists first arrived, the Kolbergs had tried to sell them on the idea of creating a powerful urban center here with all the specialist dens concentrated in one spot. The farming dens would have been clustered tightly around the city, with no room for expansion and with all their activities subordinated to the needs of the center. That idea had been rejected by the colonists, who opted instead for something closer to what the scouts had recommended widespread dispersal of the specialists and the farmers with only as much centralization as was absolutely necessary.

But the rejection—made emphatically a year ago by den after den as they broke ranks in a mad dash to land before the good plots were all taken—was not decisive enough for the Kolbergs. They were still trying to get the Asgard colony to change their minds. And that was the main topic of discussion at supper that night in the dining room of the Asgard Hotel.

"This is our colony, not theirs. If they want to run things, they can go back to Tik and do it there," said Harry Bayard, leader of den Matanuska, a farming den that had settled up near Glacier Valley.

"I agree," said Betty Montgomery. "But the question is, how do we write a constitution that protects us from the Kolbergs without creating a tyranny of our own? The law is a tough thing to tailor to specific political needs."

"Can't we just fix it so they're not allowed to play their games on our planet?" Lin asked. He had found himself at the same table as Bayard, Annie, Ed Findley, and a handful of delegates from the north who were also wary of the Kolbergs.

"It's not that simple," said Betty. "You can't name them specifically—not unless you want to change from law to dictatorial fiat. You have to phrase things in general terms. That means you close the door on your own people. Constitutions are delicate things. A little mistake here can mean centuries of difficulty for our children and grandchildren."

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Lin shivered. "I thought this was going to be like a big den council. Just make up some sensible rules and vote."

"Politics is never sensible, Lin," Bayard said. "Otherwise we'd leave it to the AI's. I'm afraid we're going to have to work hard to keep things from getting out of control. And even then, I'm not sure we can do it. Once this thing is signed and ratified, it's out of our hands."

"You're starting to get me nervous," Lin said.

"Well don't be, duckie," Betty said. "There are enough of us to write a constitution that keeps the K's from taking over. Don't worry about it."

"That's not what bothers me," said Bayard. "I'm worried that they'll do whatever they want, no matter what the constitution says."

Of the sixty dens that left Earth, fifty-seven had completed the journey to Mu Cassiopeiae and Asgard. One ship had failed to complete the twenty-five-year journey, its fate unknown. Each den contained about sixteen hundred members. Throw in the eight thousand scouts and the human population of Asgard was somewhere in excess of a hundred thousand souls.

Each colonial den had two representatives at the convention, the scouts had four. More than a hundred delegates were seated in the high-ceilinged warehouse that had been converted into a meeting hall and given the name Hollister Auditorium, after the colony ship that hadn't made it to Asgard. They clustered in groups around large tables with a laptop in the center of each one.

Lin was amazed and a little intimidated by the rich mixture of faces. Men and women from North and South Valleys, machinists, farmers, truckers, doctors, teachers and everything in between, stood to represent their dens. He felt a little overwhelmed at his own insignificance in the face of all the others. His voice was so small and his sense seemed so shallow. He was afraid that he would carry little weight at this gathering.

At the podium in the front of the hall, raised above the rest and decorated with blue and white bunting, the leaders of the ad hoc colonial commission, which had managed the colony's business since the first days in orbit before the landings began, stood in casual disarray.

As the clock neared low noon, however, they found their places. And as the numbers clicked over into place, John Porter, the head of the commission, brought down his gavel and pounded the hall into silence.

"Ladies and gentlemen, the Constitutional Convention of Asgard is hereby brought to order. . . ."

TWO

The truck bounced and jogged and slid as it made its way along the rough dirt track that climbed higher and higher above the savannah plain, jerking Joey Baxter hard against the seat belt that held him in place. They weren't traveling very fast, forty klicks an hour tops. But the way they were bouncing around, it felt like a hundred. And the shoulder harness was meant for a full-grown man, not an adolescent, leaving a lot of slack in which to slop around. His arms were red and sore from the chafing, and

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they weren't even halfway to the end of the road.

"How are you doing, kid?" asked Lucky Levesque as he swerved hard to avoid a frost heave on the middle of the track. Joey bounced against the door.

"I'll live," Joey said. "How long before you guys finish the road up here, anyway?"

Lucky laughed. "Next spring, from what I hear. They're going to work on the other side of the river this summer. Then they've got bridges to build. The little feeder roads like this one are pretty low on the priority list."

"That's a mistake. I figured it out. The driving time, round-trips and wear-and-tear make it less cost-effective to wait until the main arteries are finished. The unpaved roads use up more driving time, require more maintenance on the trucks, and they leave the outlying townships with reduced services."

The truck driver whistled. "You figured that out, eh?"

"Just a quick simulation model on my laptop. I tried two or three different configurations. The best way to take care of things would be to put a paved artery up here in the foothills parallel to the river. That way, you could operate a loop, a full circuit. Goods would travel faster and you'd be able to make a quicker run. Less time on the road."

"I'm for that. You know, the rest of the drivers have been complaining about these upland runs. Just like you said—too much time for too small a load. Did you tell anybody back at the den?"

"Nah. Who'd listen to a kid like me?"

"I guess you're right. They don't seem to hear anything us drivers tell them. Looks like we're stuck with things the way they are until they figure it out for themselves."

"Now if the Kolbergs had sold their plan, we could have a couple of ring roads with connecting spokes all centered on the urban hub. But then you'd have the congestion of a centralized transport network. Traffic would jam up at peak hours and you'd get delays and bottlenecks."

"And you'd have the bloodsuckers in charge," Lucky said with a sneer.

"Yes, you'd have the bloodsuckers in charge, that's true. Personally, I think we'd be better off if we took their advice—but only if they didn't come with it. They're right about a lot of things, you know."

"Like what?"

"I like the way they want to get things organized. We've got too much confusion here. Everyone's running off in different directions. There's no one to keep things together."

"You mean like a governor?"

"Yeah. Someone who would do what the Kolbergs want to do—only for us and not for them."

"Someone like you?"

Joey broke into a smile. "Someday, maybe. When I grow up."

"And what don't you like about the K's?"

He squinted and pursed his lips, thinking hard. "I'm not one of them."

Lucky broke out in a loud guffaw and slapped his thigh. "I guess you aren't," he said.

The track smoothed out a little bit as they approached a small lake and hugged the shore, though the holes in the gravel surface kept the truck bouncing until

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they slowed down to thirty klicks. The vehicle was a cross between a farm truck and one of the big highway rigs that ran the road between Highland Post and Glacier Valley. It had rugged suspension and a smaller bed. Today, the load was a container of plastic construction fittings from den Levitt—window frames, casements, door knobs, cleats, joints and a whole slew of specialized products. The farm dens could usually come up with lumber and men to cut it and nail it together, but the odd parts needed to finish a job were more efficiently produced on the jigs of the construction den.

Their destination was Olympia Township, nestled high up in the valley near the Vogelsberg Ridge. Joey was along for the ride because he'd heard that den Olympia was supposed to be one of the strongest Kolberg supporters in the colony. He wanted to find out for sure.

So far, he had counted sixteen dens firmly behind the offworlders—farmers, two of the educational dens, half the services dens, a health den, and even den Levitt.

Their reasons were varied. The educational dens had a lot of secondary school types, the kind that used to give Joey a hard time because of his unorthodox approach to school—he would appear once a week, whether he needed to or not, take his exams, drop off his completed assignments, and then disappear. Before he left Earth, he had worked himself up to a university sophomore reading level and was knocking off tensor calculus without breaking a sweat. Although he hadn't tackled astronomy yet, he'd found that stoichiometric chemistry was another easy subject for him. He drove some of the teachers crazy. They seemed to think he needed to be in class in order to learn something—discipline, they claimed. They were the type that supported the Kolbergs.

The doctors from den Reed, the health den from Orange County, California, treated their nurses and patients like cattle. Prime Kolberg country.

Den Levitt was full of hard-working blue collar stiffs who swallowed the Kolberg appeal to work hard for the future—and they were tired of taking the blame for the lag in building houses for the other colonists. The Kolbergs played into that by telling them that it was the fault of the woodsmen in den Bunyan and the administrators at Center Township.

The farmers were a mix of religious types and backwater boys from South Africa, Canada and the US Midwest. The service dens went along because their leaders were mean and nasty and used to city life. They were hedging their bets by backing what they saw to be a proven winner in the politics of the street.

Joey didn't begrudge any of them their opinions, although he thought a lot of them were just silly. He'd been more than a little impressed by the Kolbergs at first, until Guy pointed out to him that their plans had no room for an ambitious youth from den Middlesex who wanted to get rich as the colony grew. Somehow he knew they were not about to share the wealth with the local entrepreneurs, no matter what they said.

The truck jinked and jerked to a stop,

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skidding the last meter on rough gravel. The silence wrapped Joey's ears like a blanket. His arms and legs tingled from the vibrations of the long rough ride.

The village ran along the shore of the lake, a handful of low buildings, a single lodge, a health clinic marked by a red cross on the wall, a couple of warehouses and a barn. There were a few people hanging around in the common greensward that led to the lodge, but a long line of them, maybe a dozen or more adults and half again as many children, trailed out of the clinic.

Mud pox, Joey realized. It was spreading quickly now that spring was here. The colonists had been ready with antibiotics and medications to treat the symptoms, but there was nothing on hand to prevent it. The scouts who had returned to Earth after the first few years on Asgard brought back information —medical data and horror stories—but no samples of the virus to be used to create a vaccine or a countervirus.

Now the health dens were working overtime to produce enough vaccine for everyone, but without success. It took a week to cook up each batch in the lab, not nearly as fast as nature was doing on its own. So far, they'd come up with enough for the babies and youngest kids and those with special problems, respiratory cases and people with allergic reactions.

He sighed. This only complicated the mission he had set for himself. And it was already hard enough.

The word from drivers like Lucky and his mates was that Olympia was a Kolberg den, through and through. They'd lined up behind the interlopers early and backed them in the debates before landing. And since they'd come down only to find themselves assigned to an upland township at the wrong end of a bad road, their support for the Kolbergs had grown.

But Joey wasn't here just to count votes. He took the drivers at their word. He had a different objective in mind.

Although Peter Kolberg, his brother, his cousins, and their associates had made themselves visible throughout the colony, no one had yet learned the location of their base camp.

They must have wintered over somewhere safe and sheltered, that much was certain. But they were a secretive lot, and no one could pry the information from them.

The rumors were that it was up on Vogelsberg Ridge somewhere. Joey had played with the possibility that it was over in North Valley, on the other side of the ridge, but that didn't make sense. The bulk of the colonists and the center of gravity for the colony were in South Valley. The seacoast on the east side of Mt. Loki was ruled out after late summer storms battered the coves and beaches there. And the townships south of the river were a ferry ride too far to be of much use to the Kolberg's purposes.

So Joey had come to Olympia in search of clues.

Lucky had warned him in advance to be careful. With spring here, the convention in session, and some kind of political maneuvering already underway, the adults of the den were already suspicious and on edge. The truck driver's gentle questions had been deflected with glaring eyes and sharp remarks, leaving Joey without anything more to go on than his own suspicions.

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That left only one alternative, one that Joey approached with as much enthusiasm as following ripper tracks into a box canyon—the other kids.

Joey did not get along well with children, his own age or any other age. They were so tedious and simple, or noisy and obnoxious, or aggressive and abusive. After growing up in close proximity to the faculty of Middlesex University before it left Earth, he much preferred the company of adults, preferably educated adults, though in a pinch any would do.

The truth was that he didn't know how to get along with other adolescents. But now he had to. . . .

He found a handful of them congregated in an open space behind one of the warehouses. A basketball hoop hung from the wall and a round ball sat on the ground. That wasn't good. Joey was no good at athletics in general, but basketball in particular was alien territory for the short, slightly built teen. Then he saw one of the boy's kick the ball to his mate, who flipped it into the air with a toe and bounced it off his knee and forehead to a third youth. Soccer. There was something he could fake—if he absolutely had to. After all, you just had to kick the ball in the right direction.

He walked up the group slowly. There were nine of them, six boys and three girls. When he came within range, one of the boys kicked the ball in his direction. He took two nervous steps sideways to intercept it, hoping his uncertain moves would be laid to awkwardness and not the nervous fear that caused them.

"Don't get too close," called a boy with red hair who looked to be his own age. "We don't want to get the pox."

"I don't have the pox. I've already been checked," Joey said. "But how do I know I won't get it from you?"

" 'Cause we've been checked too," said a skinny youth wearing green shorts and sandals. Joey passed the ball to Red, who relayed it to Skinny.

"Who are you?" Red asked. "And what are you doing up here?"

"My name's Joey Baxter, and I came up with the supply truck for a ride. Now I have to wait until they turn the container around and send us back. Boring stuff. What is there to do around here, anyway?"

"You're doing it," said Skinny. "This place is dead. The pox is the most excitement we've had since we landed. All the rest of the time it's schoolwork and farmwork. I don't know why my folks dragged me here from Washington. At least there we had 3-V and the arco-mall."

"Oh Arnold, you're such a whine," one of the girls said. "That's all you boys are interested in—3-V and the arco-mall."

Skinny Arnold made a face at his taunters and kicked the ball hard off the wall of the warehouse. Red ran after it and passed it to Joey, who stretched to block it, but slipped on wet grass and went down on his face. He heard a chorus of laughter from the other kids, but ignored it and rose quickly, running to retrieve the ball.

"Ever go hiking up on the ridge?" Joey asked carefully. It was the question he had rehearsed all the way up from Center Township, the one that he hoped would lead to more information about

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the Kolberg base. He was afraid that it would sound forced and arouse suspicion. It did.

"Nah. It's too far," said Red. "Mostly we're just stuck around here. You hike much?"

"A little bit," Joey lied. "Last summer we went overnight backpacking a couple of times down at Glacier Valley. Camped out near the ice."

"They won't let us hike up on the ridge," Skinny Arnold said. "Off limits."

"How come?" Joey asked, his interest aroused. The query was a mistake. He could tell by the way Red's face froze. The girls picked it up the quickest.

"Do you like to hike or just ask questions?" asked the oldest one.

Joey shrugged and toed the soccer ball. "Just curious."

"I think he's a spy," said the girl. "Arnold, you've got a big mouth. If your dad finds out you've been talking to outsiders about the ridge, you're going to be in big trouble."

The kids had all stopped their adolescent motions and now stood in a semicircle facing Joey. He felt the skin crawl across his back and up his neck. What was he going to do next?

It was probably a good time to make his exit—if they would let him. The young girl had given more away by her response than anything Arnold had said. The suspicion, the sudden sense of confrontation, there was too much going on here for this to be a simple children's game. Joey decided to tough it out. Don't break your cover, but don't turn your back.

"You guys are weird," he said. "If you don't want to talk, then forget it. I've got a truck to catch." He shifted his weight nervously from one foot to another while Arnold, the girls, and the other boys looked to Red for some kind of guidance. It was time to go, before Red realized he should call in the adults.

"Here's your ball," he said, kicking it high and aiming it at Red's stomach. For once in his life, he wasn't clumsy and uncoordinated. The ball nearly found its mark, batted away at the last minute by Red's quick hands.

Joey backed up slowly, locking eyes with Red. When the other youth gave in, looking at his mates for support, Joey turned and walked slowly but purposefully back through the village towards where he'd left Lucky Levesque and the truck.

The kids followed him, keeping their distance, but not letting him out of sight. The more they did, the more he realized that he had stumbled onto something. The Kolbergs had to be nearby—if not somewhere in Olympia Township, then somewhere very close.

He came into sight of the village green and the truck, still a couple of hundred meters away. Then he noticed one of the younger boys in the group split off from the rest and run towards the main lodge. He was only halfway to the truck when the kid found an adult, a bearded man wearing an insulated vest and a pair of heavy boots. His heart began to pound terribly when the boy's hand went up and pointed across the commons at him.

Where was Lucky? Was the truck ready to go? He picked up the pace, but was scared to run. That would have been making the same mistake as the farm

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kids—and he was too clever for that. Would his cleverness keep him from getting away? He didn't know, but he kept on, closer and closer to the truck and his freedom.

At the last minute, just as Joey thought he'd escaped, the man in the vest began to strike out towards him. The other children took that as a sign to move in.

Joey was about to break into a run when he saw Lucky emerge from the rear of the truck. It was only a few meters away now. He was going to make it—if the kids didn't get there first.

Lucky looked up and waved at Joey, then hesitated as he began to size up the situation. But Joey didn't have time. He stepped up to the cab and, in a harsh, low voice, said: "Get us out of here and don't stop to ask questions, Lucky."

The truck driver's eyes widened in surprise, but he came to life suddenly, jumping up to his side of the cab and climbing in. Joey opened the door and—BAMM!!

—something smacked into him, and the middle of his back began to sting. He turned as he fell into the cab, looking back to see the soccer ball bounce off onto the ground and the farm kids with fierce, angry eyes closing in on him. He ignored the pain from the futile attack with the ball and slammed the door shut.

Lucky switched on the motor and the truck's wheels spun in the gravel, then they began to move. The kids jumped back as he swung the truck around in a big circle. The man in the vest scratched his head, but did nothing more as they drove off down the dirt track.

Joey realized his hands were shaking and his back hurt, but it didn't matter. He had what he came for—or close enough to it. He smiled as the distance between him and the village increased. Then he frowned. What was the next step?

THREE

Emily Baxter looked up from the workstation in the corner of the library when her mother walked into the room and sighed. She took note of the red eyes and the lines in Suzanne Baxter's face, the hesitance in her step and the slight shakiness in her hands, but she withheld comment.

It was not the first time she had seen her mother like this since the scoutship crash that killed Ray Adamcek. Emily's own feelings were still raw and torn at the edges, and she had never even been close to her stepfather.

The colony's losses had come wholesale and retail. In addition to the missing ship's three dens, there had been accidents, disease, and storms. It seemed odd to Emily that the deaths that came one at a time hurt the most.

For her and her mother, Ray's death had come as a sudden palpable shock. He was probably the colony's single greatest loss, as well. A meteorologist, he had unlocked the secret patterns of Asgard's winter storms and cleared the way for his two young students to begin accurate weather forecasts. But he had paid for that understanding with his life when the scoutship crashed. Emily hurt to see her mother making payments of her own like this.

She still had dreams about Ray herself, and occasionally, when her defenses were down, she pictured his frozen,

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lifeless body in the wreckage where Guy had found it, her imagination filling in the details of a tableau she had never witnessed herself.

She could only imagine how her mother must feel.

"And what are you up to this early on a Saturday morning?" Suzanne asked.

Emily fidgeted nervously, unsure if she should keep Guy's assignment secret or let her mother in on the latest round of intrigue her scout boyfriend had cooked up. Her main fear was that once started down that road, she would end up revealing Joey's role in the plot to uncover more intelligence on the Kolbergs. Emily didn't care much what her mother did to Joey for placing himself in harm's way, but she was afraid for herself. She would have expected her to stop Guy and Joey from conspiring and would blame her for allowing them to go ahead. No matter that she had no control over either one of them. Her mother was never fair to her, never had realistic expectations, never treated her with anything but barely concealed disappointment, starting with the day her father ran off to become a scout.

But since Ray's death, the struggle between them seemed to have relaxed. Emily felt a rare and unusual sympathy for her mother after watching the impact of the loss on her.

Two men gone.

How would she have felt if Guy were the one who hadn't come back from Vogelsberg Ridge? For the first time in her life, she saw her mother as fragile and human.

And she almost felt as if she could forgive her for the injustice in their relationship. Almost.

In any event, she decided she could risk a partial answer and hoped her mother would not press with too deep an investigation.

"I'm running through the economic reports from the dens to see if I can find signs of the Kolbergs," she said. "I figured if I found anything anomalous or some pattern among their backers and the other dens, it might be worth checking up on."

"And whose idea was that? Guy's?"

"Yeah, sort of. He asked me to look, anyway. He said you'd agree. It's a good way to figure out what they're up to."

"He's right, dear," Suzanne said as she sat down beside Emily. "What have you found?"

"Nothing about the Kolbergs yet. Just the reports on the mud pox. I never realized how much damage that was doing to us. We've lost so many days of labor that everyone's production and capital investment schedules have been set back by weeks. Can we afford that?"

"Probably not if it keeps up. Plagues are bad news, even if they aren't terribly deadly. And this one is still kind of nasty. How many have we lost, anyway?"

"Twelve—three kids. Allergic reactions, mostly. But the adults who get it are laid up in the infirmary for a week. It sounds terrible—fever, delirium, that awful rash. I hope I don't get it."

"We're due for the vaccine this week. They figure we're a good place to start because we've got so much traffic through here." She leaned back and sipped her tea. "So what are you looking for from the Kolbergs?"

"I'm not sure. Guy said to check

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production schedules. He said they're really pushing to break their labor quotas. And capital investment. He also thinks I should study a couple of the dens that are already using them as consultants to see what kind of figures they've been totaling up and look for others with the same profile."

"That sounds good for openers. Anything else?"

"He said we need to look for hidden effects too. Dens where they've sent their agents without actually taking over wholesale. He said they've been out signing up farmers and workers with labor bonds. If there are enough of them, they could seriously deflect the normal production curves for the den."

"They're the ones we have to watch," Suzanne said. "We know who the supporters are. The trick is finding the ones who are being sandbagged. When the crucial votes come up at the convention, we're going to need to know who we can count on and who we can't."

That idea made Emily feel nervous. Too much was riding on this already. What if she were wrong?

"Are you running time projections on the data?" her mother asked suddenly.

"Well, no . . . I didn't think of that."

"You should. Try and see if anything unusual pops up a few years down the road."

"That's probably a good idea. I'll do that."

"By the way, have you seen your brother?"

Emily tried to hide her face as she felt goose bumps rise from the small of her back, crawl across her scalp and meet at the top of her head.

"I think he went off on the bus somewhere. Look around and see if he left a note for you in the kitchen."

"I was just in there. No note. One of these days, I'm going to murder the little son of a gun. If he comes in, tell him to come looking for me."

She lifted herself from the bench with obvious discomfort and pulled her robe tight around her, then she headed for the door. She paused with one foot in the hallway and said: "I just hope he's not running around spying for Guy again. You remember the last time that happened. He was stuck up at Jasper Township for three days."

"Yes, Mother," Emily said, hoping the tone of her voice, her eyes, and the shaking of her hand would not give her away. She held her breath until she heard her mother all the way down the corridor in the kitchen.

"Mr. President?"

"Mr. Santaniello, do you wish to be recognized?"

"Yes, Mr. President."

"The chair recognizes the delegate from den Camellia."

"Thank you, Mr. President. I wasn't going to speak on this motion, but I find that I must. . . ."

Lin Palmer leaned back in his chair and tuned out the monologue. Santaniello was just like all the others who had started their remarks the same way. If he wasn't going to speak, then why didn't he keep his mouth shut? Lin's back ached almost as much as his backsides and his mind had turned to mush long ago. Two days in Center Township and all he had heard was an endless stream of parliamentary jargon and po-

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litical double-talk. Nothing had been accomplished in all that time except to make every delegate weary of the process and wary of their fellows.

Lin looked around the chamber. The number of empty chairs was far greater than the number of those still occupied. Where had everyone gone? Or more to the point, why was anyone still here?

As soon as the light flashed in his mind that no one was here because there was no important business going on, he found himself rising to his feet without conscious thought. Once up, he let his feet carry him to the rear of the hall and out the door.

He didn't really regain possession of his senses until he was in the street, breathing the sweet, clean air that blew in from the sea and warmed his face, away from the numbing drone of the delegate from den Camellia.

He looked around. The Hollister Auditorium was situated at one end of a long green—although it was more aptly named a gold, for the deep yellow tint of the chloroplasts in the close-cropped savannah grass. The late afternoon sun was dipping towards Mount Thor—it was still midway between dinner and supper. Across the commons a row of shops and storefronts was anchored at one end by the hotel and at the other by a large dining hall. And next to the dining hall was a small building with narrow, dark windows where a crowd of men and women were outside, seated at tables or milling around. He recognized them as delegates to the convention.

Lin Palmer was not a man who took long to make a decision. He marched quickly across the grass to join his fellows and take a closer look at their place of refuge.

The building turned out to be a tavern—one of many that had popped up like mushrooms here in Center Township. A half dozen tables were set up in front of the establishment, more were visible through the door beyond the mass of colonists, and two men were dispensing pitchers of amber fluid from a giant barrel. Lin recognized them from the cut of their clothes and their hair as scouts.

"Mr. Palmer, over here!"

He recognized the odd-sounding voice of Betty Montgomery and turned to see her at one of the tables, waving to him. He made his way through the crowd and took a seat on the bench as the others moved aside to accommodate him.

Betty introduced him around the table. Two of the delegates he already knew—Ed Findlay, and Harry Bayard of den Matanuska.

"So what do you think of your first glancing blow with the democratic process, Lin?" the Alaskan farmer asked him.

"Do they always talk like this?"

"No, sometimes it gets bad."

He winced and some of the other amateur politicians moaned. "Seriously, Harry, when do we get down to business? I thought we came here to write a constitution."

"Sorry, Lin. You must have made the mistake of taking the call to the convention seriously. The truth is that there's way too many of us to do that job. Legislation is like sausage—too many ingredients spoil the flavor."

"Also, you shouldn't watch it being made," said Betty, hoisting a plastic

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mug of beer. Someone passed Lin a mug of his own and he sampled the contents gingerly. It was bitter and a little green, but it was cold and it washed the dust and dessicated words of the convention hall out of his system.

"We won't even start work on a constitution for two more days," Bayard said.

"But that's when we all go back home," Lin said.

"Exactly. The job's going to be done by a committee. And by the lawyers in den Putnam."

"And by James Madison and Sander Gutierriez and Wu'er Li Xi and the rest of history's best constitutionalists," added Betty.

"True. Plagiarism is the sincerest form of flattery. But that'll all happen while you're back on your farm. You'll be called back here when it's done to ratify the finished product. That's when the real fun will begin. Wait until you see how these honorable delegates react to a decent 'Bill of Human Rights.' You think they're appalling now, you ain't seen nothing yet."

"Why?" asked Lin naively. "What's wrong with a bill of rights?"

"Nothing, as far as you and I may be concerned—though I'm giving you the benefit of the doubt here. But the sad truth is that most people don't want their fellow men and women to have too many rights. They don't believe in free speech, free news, free enterprise or democracy. What they believe in is getting the most they can for themselves and the least for everyone else. They would rather see people shut up and do what they are told—or at the very least be told what to do. They don't want free economic competition, they want a monopoly that guarantees them wealth or income without requiring them to adapt to change. They believe in power and authority, not self-determination. And when any of them get it, popular will and the public good go right out the door. No, Lin, if we get a constitution through this convention that talks about human rights, it'll be because we slipped it by them in the dead of night when no one had the sense or the strength to talk it to death."

"That may not be a bad floor strategy, Harry," Betty said with a leering grin.

"Take notes, dear, take notes."

"And what about the rest of the business? How do we organize a government? How do the dens share power? What about courts and a legislature?"

"Technicalities. Power sharing is a matter of mathematics and demographics. The lawyers'll come up with a few formulas, point out the strengths and weaknesses in each, and then we'll find out just what kind of people this colony is made of."

"What do you think we're made of?" Lin asked pointedly.

Bayard frowned, then wrinkled his brow.

"The vote to let the Kolbergs run things was damned close before the landings started," he said. "Granted, we all came down according to the scout plan—or close to it. But if things had gone one whit differently, we'd all be sitting around right now signing labor bonds with the Kolbergs in return for this pitcher."

He refilled his mug carefully, as if

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to illustrate the precarious state of the beer supply.

"You don't sound too optimistic."

"Are you?"

"I've met the Kolbergs, so I know what we're up against."

"And?"

"If they scare everyone else half as much as they do me, and if they make everyone a quarter as mad, then I don't think we'll have any problem getting anything we want from these delegates."

"Bravely spoken," Harry said. "But I think you have a noble and idealistic view of humanity that isn't borne out by the facts. The truth is that people are afraid of freedom. It gives them the willies. Most of us never learn how to deal with it. Those that do take half a lifetime. Stability and security are much more inviting. Change only makes people nervous. Most of human history has consisted of a struggle between people who are afraid of freedom and those few who demand it. I don't think Asgard is going to be any different."

"And who's going to win?"

He paused dramatically, looking Lin straight in the eye as he drained the beer from his mug. "If I knew the answer to questions like that," he said, "I never would have left Earth."

FOUR

If anything, the ride up to Olympia Township was worse in the back of the truck than it had been in the cab. This trip, Joey was sandwiched in with a dozen boys and girls, most of them older than him. The canopy protected them from the cold north wind that blew down off the ice, but it didn't shield Joey from the unusual scents of his companions.

They were from the service den in Center Township—den Franklin. While ostensibly a midwestern group from the old St. Louis arcology, they resembled a mixture of Third Worlders more than anything else. All but two boys and one girl were a mixture of Latino, African, and Asian.

Joey wasn't sure if it was their food, the clothes, or their personal hygiene that gave rise to the odd smell. It wasn't offensive enough to single out any one source, but it was distinct enough to send shivers of doubt up and down his spine.

What if the Kolbergs could tell that he didn't smell like a serf?

Otherwise, his disguise was complete. He wore the same blue clothes and parka, workboots and loose cloth hat—the uniform of the service workers. He tried to mimic the testy, aggressive attitude that the boys adopted, although his heart wasn't really in it. He was accustomed to a more easy-going approach, catching people off guard by letting them expect an innocent young boy and then presenting them with a razor-sharp computerlike mind that was three steps ahead of them.

But he knew it was not an act he would be able to pull off in these circumstances. Any violation of expectation in this role would only call attention to a whole bag full of inconsistencies, eventually leaving him unmasked. . . .

The first few minutes of the ride had been the worst.

The oldest of the boys knew he was an outsider. Pedro Sanchez had gotten him into the work detail in return for a

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half-kilo of tabacky from some Alaskan farmers that Joey knew. Lucky Levesque had connected him with Pedro as a favor, but the young serf was not so altruistic. His young brothers were even less so.

"You got any more weed?" they asked when the truck began its bouncing trek up the gravel track leading north from Center Township.

When he told them he hadn't, they refused to believed him. They were not satisfied until they had stripped his parka from him and held him down while they went through his pockets. They were as empty as they'd been when Pedro gave him the outfit. The boys made a few disparaging remarks, then let him go. He had pulled himself together and found a place to sit away from the rest of them at the front of the truck.

He caught the eye of a young Asian girl who smiled, then ignored him for most of the trip.

The boys, having completed their amusement with Joey, spent the ride keeping themselves busy with a frightening game that made him appreciate soccer a little more.

The game centered on a piece of metal the size of a baseball. One side was machined or cast into a smooth hemisphere, but the other was raw and ragged with sharp surfaces and gruesome teeth.

The object was to toss it spinning into the air, then grab it by the smooth side.

Each of the young toughs took turns, passing it around and around the crew. They ignored Joey and the girls with a sneer. Joey was just as happy that they didn't ask him to join him. Especially when the game began to draw blood. He tried not to watch too closely after that, but the sharp, stifled yelps of the boys who missed the smooth side drew his attention each time.

Then the oldest of the group leaned forward and called: "Hey, schoolboy!"

Joey looked up to see the chunk of metal sailing through the air towards him. He just had time enough to recognize that the smooth aspect was facing him, then he reached out and caught it with one hand. It stung his palm, but he was surprised at its light weight. Probably aluminum or some alloy.

He looked at it closely, turning it over in his hand. He was only marginally aware that everyone in the truck had their eyes on him. He hefted it, spun it, touched the sharp projections on its ugly side, then tested it with a twist of the wrist.

There was a trick to the game, he realized. The piece of metal was not uniform in density. The center of gravity was much closer to the smooth side. And there were patterns to the way it spun in the air, gyroscopic effect turning it around on its axis. He tossed it once to watch it, analyzing the precession rate and axial tilt.

Then he started. He tossed it and spun it, tossed it and spun it, faster and faster and faster. The action of the wrist controlled it all, he realized. Once you got that down, you could do whatever you wanted to with it.

He tossed it higher and watched it tumble into his hand. He spun it faster and watched the flashing teeth cut the air. Each time he slapped it hard before launching it back into space. It was

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really child's play once you analyzed the precession.

He looked up the length of the truck to see ten pairs of wide white eyes locked on the spinning chunk of metal, amazed by his performance. It caught him off guard, and this time he grabbed the wrong side of the orb.

"Shit!" he yelled as he felt it catch on his thumb. He dropped it to the bed of the truck with a loud clunk and stuck the injured digit into his mouth.

The other boys made derisive remarks, but Joey recognized the awe and respect that they were meant to conceal. He looked at the palm of his hand, already red from the punishment of catching the easy ride, now marked with a half dozen small scratches to match the cut on his thumb. He hoped he had paid the price of admission to the group with that pain—at least for one day.

After an hour of torture, the truck rolled to a stop, the rear flap opened and the kids piled out into the bracing cold air. A bright sun burned down from high overhead, relieving the cold where it fell, but leaving a biting chill in its shadow. A few hundred meters to the north, Joey saw the chalky white cliffs of the Vogelsberg Ridge behind a thick stand of greenwoods.

Clustered around the base of the massive trees were a collection of huts, tents, cabins, and inflatable plastic warehouses. To the south was a long flat stretch of clear land—a natural meadow scraped out long ago by a retreating glacier. At one end was a miniplane under a camouflage screen. At the other, under a larger screen and tucked into the edge of the woods, was the bulky, winged shape of a scoutship.

He had found the Kolberg base camp!

Pedro Sanchez had confirmed his suspicions, of course, but this was the real thing, not just some talk over a bowl of tabacky. Pedro said he and his family didn't like the Kolbergs any more than the other colonists, but the den was being paid well for its work. And the members of den Franklin had never had much to say about where its leaders sent them. "We do what we're told, Joey," he had said. "And we don't ask a lot of questions."

The scouts had tried to find the place for a year now, but without success. Their sensor equipment wasn't exactly designed for the task, and the Kolbergs had taken some effective precautions, like the screen and probably some other countermeasures suggested by Joey's active imagination. Den Olympia had given them the space they needed in an arroyo near the crest of the ridge. And den Franklin had supplied them with whatever labor they needed to keep their camp maintained and secure.

Joey took a deep breath of the crisp air and followed the rest of the group into the middle of the camp. After counting latrines, tents, and ration storage, he figured there was enough working and living space for about a hundred people. That matched up with what Guy Stanger had told him about the Kolberg party. Most of them weren't at the camp, Guy had said. They were out in the townships, trying to sell the Kolberg management plan to unsuspecting and disadvantaged colonists, though Joey knew there were few left that hadn't

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already made their decision by this point.

"Gather round," Pedro called, once the group had reached the center of the compound. Joey huddled with the others, trying to blend in with the work detail. A second truck from den Franklin had pulled up in front of the main lodge of the camp. Pedro and a couple of men unloaded the cargo—a collection of small plastic cylinders with hoses and shoulder straps hanging from them.

"Here's the job for the day, kids," Pedro said, once they had formed a semicircle in front of him. "Everybody gets a spray tank. Everybody gets a partner. Everybody gets a package of flags. You get assigned to your sectors. You search your sector for snow pools—puddles, ponding, standing water of any kind. You spray the pools. You leave a flag."

Joey listened carefully, even though he already knew the drill. The young toughs who had first terrorized him and then turned into admiring fans of his fancy handwork now joked and jostled one another, ignoring Pedro.

"Everyone understand?" Pedro asked. "Yuli, how about you? What's the job?"

Yuli was the tallest of the group, though not the biggest in mass and muscles. He grinned, then stammered, then grinned again.

"I thought so. I will repeat your instructions again. This time, listen to me carefully." He went through the list slowly, emphasizing each word. This time the rest of the crew listened to what he said. Then Pedro split them up into pairs and assigned them to their sectors.

Joey wound up with the sector that contained the wooden lodge. Pedro knew what he wanted. And for a partner, he drew the Asian girl who sat opposite him on the truck.

Peter Kolberg paced the room nervously, warming himself before the fireplace, worrying about the mud pox. The colonists were so stupid. They should have taken precautions. They should have been more sanitary.

He stopped at the wide table covered with reader-disks, laptops, and a big memory tank. The figures were on the screen of the main terminal. His dens had already lost 10 percent of their labor force to the ailment for a month. How were they going to make it up?

How could they let themselves get caught by this? If they had listened to him six months ago, this wouldn't have happened. They'd had epidemics on Tik the first few years. His own parents had been caught in the first one and hadn't survived. One of his daughters barely lived through the last of them, before the colonists learned how to cope with alien bacteria and viruses.

But this—this was a matter of hygiene.

The pox was spread by chites that bred and laid eggs in the shallow pools of snowmelt and spring rains. The larvae filled the pools, fed on the Asgardian equivalent of algae, grew into adults and spread the virus. It all happened so quickly, the colonists were caught unprepared.

The scouts should have warned them, Kolberg cursed. But then, the scouts never found out where the pox had come from. It had hit them the first year, and they had recovered without knowing its

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source or solution. The next year, they'd already learned to spray the pools and kill off the black chites that spread the virus. As long as they kept the bugs under control, the pox never returned. The isolated cases that cropped up over the years were treated with acyclovir, but the cause was never tracked down.

It was only now, with colonists all over the place, living near the snow pools and mud puddles and drainage ponds, that the pox had come back with a vengeance, laying out colonists by the hundreds.

Peter Kolberg swallowed his anger and turned his thoughts towards higher goals. In the long run, the epidemic would work in his favor. He could point to it as another sign of weakness among the colonists. It was another reason why they should accept his proposal.

Behind each failure was another victory. The plan was so clever, so perfect.

He wiped the screen clear of the depressing figures and called up a spreadsheet that always made him feel good, strong and powerful—the economic projections for the Asgard colony. Even with the consequences of the pox factored in, they were reassuringly bold.

The colony planned for an annual growth rate of 5 percent. Half of that would come from natural expansion, a steady birthrate and the longevity of the colonists. He would have liked to see the birthrate even higher, but he'd learned on Tik that there were some things that couldn't be forced. The other half would come from additional colonists, another ship each year to start, more later on.

He ordered the program to begin its iterations, totaling productivity, investment, return on investment, market growth, capital and labor pools, all the sparkling numbers that meant more to him than all the living men and women on the planet. It ran through the first cycle—twenty years Asgard time. The population would double by then. New dens, homegrown and flown in from Earth, would fill in the lands to the west and south.

There were two sets of figures in the spread-sheet. One showed the colony if left to itself, following trends that were already beginning to appear. The other showed the effect of careful management by Kolberg and his associates. As time went by, the two numbers diverged more and more.

He keyed the program to continue with the next cycle. Another twenty years, more divergence. The numbers in the Kolberg columns swelled and Peter Kolberg swelled with pride at the sight of them.

Years ago—fourteen years as Earth reckoned time, more then ten years by the slower calendar of Tikarahisat—Peter Kolberg had worked the rich black soil of his farmstead under the small, hot sun Eta Cassiopeiae. He knew even then that backbreaking labor was not his fate, that a life of endless summers followed by endless harvests was not his lot. Even then the vision was alive in his mind, in his soul.

He knew it would take a long time. Longer than anyone could imagine. But he knew also that he would have that time. All the time he needed, and more, in endless quantities.

The colonists were so stupid—stupid and ignorant. They did not know what was good for them. They could not see

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what they needed or how their petty selfish interests kept them from getting it. And what they needed most was someone to tell them what to do, how to order their lives, organize their efforts and build a world worthy of the stars.

It had taken him a long time to build up his power on Tik. Years of work, years of learning. All that he had planned and all that he had learned was being compressed here on Asgard. The time was so short. Soon they would have to act. The pieces were beginning to fall into place.

They had scout holdings in the back country. They had dens beholden to them. They had colonists bound by labor contracts. They had votes in the constitutional convention. Everything was coming together—but so much more quickly than back on Tik. The pace was almost frightening. Almost.

He looked again at the spread-sheet unfolding the future of the planet, calculating across the decades, growth upon growth. This was the crucial time for all those numbers. The decisive moment was coming—only a matter of days now. Until then, time seemed frozen as solid as the glaciers on Mt. Loki.

And afterwards, it would unfold, like the lines of numbers in the spread-sheet, building and rising inexorably to some ultimate climax in the distant future. A future where the name of Kolberg would be written in letters large enough to blot out the sun. . . .

"Peter, are you in there?"

His brother, Eric, entered the room. He was older than Peter and taller and more handsome. But Peter was the one with the vision, the one who had nurtured it and made it real. Peter was the dominant brother, while Eric followed along effortlessly in his wake.

"Over here," Peter said.

"Are you going over those numbers still?" his brother asked.

"Yes. What of it? They are interesting to me."

Eric smiled and shook his head. "It's time for lunch with the den leaders from Jasper. Hannah sent me to fetch you."

"Den Jasper? Oh yes, that's correct. I'll be right with you." He lingered for a moment before the screen, watching the bottom line for Asgard grow in leaps and bounds, his heart soaring with the numbers. Then he stepped down from the heights of his reverie and executed the reset command. The screen wiped itself clear and the original numbers reappeared, the present state of the Asgard colony in all its stark reality. He turned his back on the momentary truth and walked off to the dining hall and a distant future.

The numbers were still there a few minutes later when Joey Baxter slipped into the hall unnoticed. They were practically the first thing he saw. The clutter of readerdisks and laptops was uninteresting and uninviting. Too much work to see what was in them. But the bright numbers beckoned like city lights in the night.

Joey had left the little Asian girl, Jennie Vinh, at the truck while he did his spying. The two of them had worked for a couple of hours, spraying the snow pools and mud puddles around the compound.

"What is this stuff?" Jennie had asked.

"Mylotropin."

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"What's that, smartcakes?"

"It's a growth agent. It interferes with the chite's hormones so they don't grow wings and mature. They cooked it up at the university."

"What happens if we get it on our hands?"

"We don't grow wings, I guess," Joey had said.

Jennie didn't want Joey to go inside the lodge. She said they'd think she was in on it, too. So he took her back to the truck and told her to turn around. "Now you can tell them that I disappeared while your back was turned."

Joey's eyes were fixed on the spreadsheet, taking in the numbers, the categories. He recognized it for what it was almost instantly. Emily had been running similar spreadsheets all week long at home. It didn't take more than a few seconds for him to start the iterations.

A broad grin split Joey's face as the spreadsheet scrolled up, year after year, decade after decade, numbers in rows and columns marching in rigid formation up the screen and across Joey's eyes.

It had reached well past three centuries into the future before Joey realized there was someone else in the room.

"Who are you and what are you doing here?" asked a man with thin hair and a dark face—Peter Kolberg.

FIVE

Joey's first regret was that he had failed to inform Guy Stanger of his plans or his whereabouts before leaving Center Township. It was not his last.

The next one came when they dragged Jennie Vinh into the lodge. She struggled with one of the big men who had come running when Peter Kolberg called. When she saw Joey, she flashed him a venomous look that made him feel as worthless as a snow lizard, then they dragged her away.

Now they were both in trouble.

"Just looking around, sir," Joey had said.

"Are you a thief? Is that what you pretend?" Kolberg had asked in return. "Show me your hands. I thought so—too soft. You're no serf, even with dirt smeared on your face. Who are you? You look like the boy they chased off at the village last week. Was that you? I think so, little bird."

Joey fell silent after that. He was afraid and worried, but he refused to talk and hoped that would be enough. It wasn't.

Kolberg had him sit in a chair at one end of the room. An hour went by without either of them uttering a word. Joey's heartstrings tightened with every passing minute, as he considered his options. In a few days, if he didn't show up, someone would come looking for him. If the Kolbergs didn't suspect that he was anything more than a mischievous child, they might even send him home before then. Or they might suspect the truth and decide it would be better if he never turned up. . . .

Kolberg continued his business silently, writing on a laptop, reading a disk, playing idly with the screen on the table. After a while, the man who had captured Jennie entered the hall. "She says she doesn't know who he is or where he's from. She said Pedro Sanchez brought him along."

With a wave of his hand, Kolberg

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dismissed the man, then returned his attention to Joey.

"See, I told you you were no serf. Do I have to bring Pedro Sanchez in here and question him too?"

Joey just glared at him and bit his lip. A few minutes later, Pedro appeared, flanked by the first man and a newfound friend. Kolberg questioned him just out of earshot, which only made Joey sweat coldly. Then he saw Sanchez look his way and shake his head in vigorous denial. Pedro exchanged more words with Kolberg, facing him boldly with a stern defiance in his carriage and expression. Joey tried to adopt a similar posture in his four-legged prison.

"He says you came to him in Center Township and asked for a job. He doesn't know what den you come from. Thought you were a farmboy. I don't believe him, but what can I say? You are a great deal of trouble for me now, boy. I should have done this first."

He motioned to his gorilla and the man approached Joey menacingly, pulling an ominous tubular device from his pocket. He put one arm around Joey's head and poked the business end of the device into his right eye.

"Open your eye!" he commanded. When Joey did, he pulled the trigger and a bright red flash filled one side of his vision.

"I'm going to run your retina print through the colonial roster to find out who you are," Kolberg said. "This will take a long time and I do not like to waste time. You will sit there and you will not move until we end these mystery games."

Two more hours passed while Kolberg came and went. The big man with the retina print gun stood guard while his master was gone. Joey sat and brooded. What had he done that was really so wrong? He hadn't heard anything. He hadn't seen much of anything at all. Just that spreadsheet on the mainframe, and that wasn't anything. These guys were wrapped too tight for him. Suspicion was one thing, but this was pathological.

Finally, Kolberg returned, a strange, lopsided grin on his face, as if smiling was an occasional and poorly handled practice. "So, Joseph Baxter, what a surprise to have you with us. You look a little like your mother, you know. I am curious, though, as to why she would risk sending her youngest child on such a silly and foolish errand as this one. Spying is something that adults should do, not children."

Joey swallowed hard. "But—"

"Take him away," Kolberg ordered. "Put him in with the girl. We can't have him interfering with us now. The next few days are too important."

The gorilla grabbed Joey hard by the upper arm and fast-marched him down the hallway to a door near the end. The door opened into a dark room with no windows. Joey could see a couple of mattresses on the floor, some blankets, and an irregular shape on one mattress. Then the man pushed him inside and closed the door behind him.

Joey reached around in the dark until he found a light switch. The bulb was dim and the light barely enough to make out the shape on the floor as that of another person. Joey gasped and shuddered in surprise, then recovered himself.

"Hello?" he asked the immobile fig-

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ure. There was no reply. He knelt on the mattress and pulled back the blanket. He gasped again. It was Jennie Vinh.

She moaned and opened her eyes. Even through the blanket, Joey could feel the fevered heat that her body gave off.

"I feel sick," she said weakly.

Joey looked closer at the bumps that had begun to rise on her forehead.

Mud pox!

"Oh great," he said.

Friday nights in Center Township were a strange and tantalizing experience for Guy Stanger. He'd grown up in the austere isolation of the Main Post, one of only six active scout posts on the planet and more than forty klicks from its nearest neighbor. A big celebration was the annual jamboree, when more than half of the scouts on Asgard gathered together, either down at Main Post or up at Highland Post.

Weekends were distinguished by a half workday on Saturday and a holiday on Sunday. Friday nights there were dances for the kids, Saturday nights for the adults. He had never considered it boring, but then, he'd never had anything to compare it to. Until now.

Center Commons was a large open square, glazed pavement surrounding a large, newly mown green. At one end was Hollister Auditorium where the constitutional convention was being held. The village holdings of four dens met at this juncture—one of the executive dens, special services, the food den and den Franklin, the service den.

People thronged the square, jostling through the streets, calling out, laughing, running, sitting on the grass in large circles, playing instruments, singing, dancing. Around the perimeter was a strange collection of shops and storefronts, whose products and purposes defied all rational explanation. Grog shops offered homemade ales and distilled liquors, darkened clubs hawked private intimacy, and those sporting decorative lighting on the outside solicited dancers. Sweet, sick smells issued from some doorways, while others gave forth the rich tang of roasting meat, baking bread, and real coffee.

The complex wealth of sensations was enough to overload Guy most nights. But this evening his mind was focused on something else, and the crowded square barely existed for him.

He made his way purposefully down the street, inspecting each shop as he approached it. He was halfway around the commons before he found what he was looking for—the Silver Rose Tavern, its crudely lettered sign on the back of a packing shield lit by a single yellow light.

The door was open to the warm spring night, but two men blocked the entrance with their wide backs. Guy levered himself past them and stepped into the dim interior of the tavern. The air was thick with the smell of spilled ale and burning tabacky. He looked around cautiously, holding his breath against the reek.

He didn't like what he saw. The place was a hangout for scouts. He recognized several youngsters in the back from the Main Post who shouldn't have been allowed in the place. There were others, too. A couple of old men, part of the original scout team, who made no attempt to hide their indiscretion. And in

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the corner was the man Guy was looking for: Mike Hennig.

Only a few weeks had passed since the night Hennig told his fellow scouts that he and his mates were selling off their title to large back-country holdings in return for a piece of the Kolberg enterprise. Guy had been in the cramped room then, had seen the bitterness in the eyes of the other scouts, had heard the anger in their voices. He bit back those same feelings now, bending them to a greater need.

He crossed the room and slipped into a plastic chair across from Hennig, who clutched a mug of ale in one hand and a scout knife in the other.

"Good evenwatch, Mike. I haven't seen you since the High Council last month. What have you and your mates been up to?"

Hennig scowled, drank from his mug and wiped his mouth with the back of his hand. The knife blade flashed a brief reflection from one of the hooded lights hanging overhead. "Do I know you, scout? No, I don't know you. But I saw you at the Council, didn't I? You were back against the wall. You came in with Sanderson and Gilmartin, but I've seen you somewhere else. I know—you hung around with Grampa Bob. You were one of his boys, weren't you?"

"Yeah, once. A lot of scouts were," he said, emphasizing the last word.

"I guess so. I used to listen to the old ripper when I was a kid, too. Him and his Great Spirit stories. Crazy old man. Nobody ever believed in the Great Spirit—especially him."

Guy shook his head, swallowing a lifetime of devotion to an old man and his allegorical tales of life on Old Earth. "I guess not."

"So what do you want here, scout? Don't you know you're not supposed to be talking to us? We're outcasts. At least Grampa Bob got to take his dignity with him. And what did he do that we didn't? He's left the scouts just as sure as we have."

Yeah, thought Guy, but at least he didn't sell the scout den out like you did. Hennig and his compatriots had signed over to the Kolbergs title to thousands of hectares of virgin land in the interior of the continent. Guy wasn't sure what they were getting in return besides a lot of starry-eyed promises. What they had given up was plain to see—their self-respect.

"I need your help," Guy said.

"That's a good one," Hennig said. "Any reason you expect to get it?"

"Not any in particular."

"At least you're honest."

"Yes, are you?"

Hennig came up quickly, the knife cutting through the air. Good, Guy thought, he hadn't sold all of his pride away. He didn't flinch, but looked Hennig straight in the eye.

"If you weren't a scout, that would have been your last question."

"I'm looking for the Kolberg base camp. I thought you might know where it is."

Hennig relaxed. "You've got to be kidding."

"Not at all. Three days ago, my girlfriend's kid brother disappeared. He said he was going looking for the camp. I want to find him. If I knew where the camp was, I might have some direction to start in."

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"Sounds convincing. What's your real reason?"

"That's it. The kid's only twenty-two."

"A real little scout."

"He's not a scout, he's a colonist."

"And that's supposed to make him count."

"No—but I thought the honesty might."

Hennig frowned, then looked Guy over carefully. He plucked at his nails with the tip of the knife. "The Kolbergs don't want visitors. This is a private club—and you already decided the dues were too high to pay. Look somewhere else, scout."

The renegade fell back in his chair and turned his gaze away from Guy, concentrating on the blade in his hands.

Guy felt angry—and shocked. He really had expected the scout to help him. Somehow, he thought, their common kinship would have made a difference. Feeling terribly naive, he rose quickly to his feet and headed for the door. He tried to ignore Hennig's rude laugh as he slipped outside, but it found its mark. The common bonds between scouts, the basis of all society on Asgard until the arrival of the colonists, had been shattered by the Kolbergs, and could never be made whole again.

He stumbled up the street, lost in embarrassed thought, unaware of the people around him. He was halfway to Hollister Auditorium before he realized where his feet were carrying him.

"Guy?"

The voice was familiar, but terribly out of place. He stopped abruptly and looked at the handful of strangers around him until he found its source—and his blood froze.

"Guy Stanger, what have you done with my son?"

It was Suzanne Baxter.

SIX

Lin Palmer plugged the fibercable from the laptop into the jack on the table, and called up the agenda for the committee meeting.

After a week on the farm, he was back in Hollister Auditorium. He'd been assigned to the Committee on Den Affairs, and its job tonight was to review the bylaws and constitutional articles on the definition, creation, rights and duties of dens.

The agenda appeared on the screen of the laptop. There was only one item under consideration—a resolution on the bylaws. The meeting had begun at 2500 and would probably go on until midnight. And a full session of the convention was scheduled for tomorrow. Lin grew tired just contemplating the long hours of speechifying and legal wrangling. Tonight's committee meeting was bad enough.

He asked for the file on the evening's resolution. The bylaws rolled up on the screen, chapter, section and paragraph, about 60K's worth of copy, then the constitutional articles, shorter and more to the point, another 40K. He tried to plow through the legal language, but found himself lost in the first few subparagraphs. He traced his way back to the place where he got lost, but the subordinate clauses and indeterminate appositives swallowed him alive.

He ordered up the legislative summary—the plain language explanation

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of the measure. But after a few minutes, a message flashed on the screen: "FILE OPEN—NOT AVAILABLE."

"Hey, Betty," he called softly to his colleague at the next table. "What's the story on this?"

He pointed the screen of the laptop at her.

"Last minute amendments," she said. "Bayard says they're trying to come up with some substitute language. We'll get it later."

Lin shrugged. What difference would it make? He barely understood what they were talking about. Oh sure, he knew what a den was. And when new colonists started arriving, there would be new dens on Asgard, each with its own landholding—townships for the farmers, villages for the specialists. You had to have rules to make sure everyone was treated fairly and equally. But why couldn't they be written in language that ordinary farmers like him could understand? The lawyers from den Putnam wrote everything up, told the delegates what it meant, then waited for them to approve it. Why did they even need him in the first place?

The chairman called the meeting to order and the murmur of conversations subsided. They ran through the minutes of the first meeting, then the chairman called on the legal aide from Putnam to explain the language in the resolution.

It didn't help. Thirty seconds after she began, he was lost.

He kept asking for the summary with his laptop, but all he got was the same message. Then he found the message was interrupted by a new graphic—a bright red "SPECIAL NOTICE" warning.

He looked up to see several other delegates staring into their laptops with puzzlement in their faces. The legal aide fell silent and the chairman called a pause in the hearing.

"Notice from the president of the convention—" The words scrolled up across the screen.

"Quorum Call—All delegates to the Constitutional Convention are requested to return to the meeting hall at this time—Quorum Call.

"Peter Kolberg of the Tikarahisat colony at Eta Cassiopeiae has asked to address the convention in special session this evening. As a courtesy to him, the president has issued a quorum call for a session to begin at 2600."

Lin blinked in surprise, a couple of delegates nearby moaned, and the chaotic babble of a dozen startled conversations echoed from the high ceiling. The chairman pounded the gavel a few times to bring the meeting to order.

"In view of this request, I suggest that we recess this hearing until after the special session. So moved and seconded, all in favor say 'Aye,' the motion carries. We are in recess."

The swiftness of the action surprised Lin, but he realized that the handling of the delegates required speed and a deaf ear for objections.

He was left to sit for another hour as the sergeant-at-arms appointed a handful of deputies and sent them out in search of delegates.

"You three go to the hotel, you four up the west side of the squares, and you four up the east side. I will personally attend to the special services quarter and return here within a half hour."

That brought a round of hooting from the deputies. Lin smiled too. He knew

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what the sergeant-at-arms was talking about. In addition to hairdressers, security guards, artists, dancers, musicians, video crews and producers, the special services den had also brought along specialists in an older profession. Some of the more puritanical dens frowned on the idea—as did Lin's wife, Jackie. But the delegates—the male delegates, anyway—found it the source of endless ribald humor.

The delegates thus retrieved by the deputies and the sergeant arrived in all different state and moods. Some were indignant about the interruption in their private affairs, some were oblivious to the interruption following their overindulgence in homemade refreshments. A few continued to sing songs from their homelands until the gavel fell and the convention was called to order.

"Fellow delegates, I present to you our guest. . . ."

"My name is Peter Kolberg. My family and our friends came to Tik fifteen years ago—twenty-one now that we have come to Asgard for this year. Little more than six months ago, I spoke to you while you were still in your ships orbiting overhead. I offered you our aid and support.

"I told you how we built a strong and stable colony back on Tik. But at the same time we made mistakes, we wasted time, we lost money, work, and lives. We are so small out here, there is so little room for error, that each of those mistakes cost us dearly. We wanted to save you that cost and help you reinvest it in building your world.

"The Kolbergs offered you all the assistance we could provide. We formed a management consultant team to help you organize your colony. We brought our technology and our technical libraries. And we brought ourselves. We offered you a contract with us that would make Asgard grow and thrive and flourish.

"In return, we asked only for a stake in your world—a few tiny pieces of land here and there. We asked to build and grow with you. We are natural trading partners, you and we. Sol is twenty-five years away from here, we are only six. Beyond us are a dozen worlds ready to be settled in the next few centuries. Asgard and Tik will be the gateways to those new worlds. We have a long future together.

"But you chose not to.

"I do not hold this against you. You did not know us. You did not know what we could do. We expected this, but felt compelled to make our offer anyway. Since then, much has happened.

"You, too, have made mistakes. You, too, have wasted time and money and lives. If you had listened to us last year, some of that waste might have been avoided. But that is our fault. We should have tried harder to make you understand what we can do for you.

"But now you can see what we are about. We have come only to help you. We can give you valuable guidance if you let us.

"I have come to you tonight, before you continue with your work, to make our offer once again. Let us show you the way to a rich and powerful new future. Let us lead you to a new age among the stars. We have the knowledge and the will that you need.

"This will be the last time we offer you this opportunity. Our time here is

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drawing near an end. Before the end of this year, we will be leaving for home. We make the offer now and it will remain open until Sunday night. We do not want to split the colony up over this—the decision must be quick and final. There is too much work to do for all of us to delay this any longer. Thank you. Good night."

Suzanne Baxter watched Peter Kolberg as he stepped back from the podium and returned to his seat. She felt like she had stepped back in time a year, back to the bridge of the *Hamilton* where she had heard Kolberg's first speech. It was a chilling feeling. Back before Ray's accident. Before Joey had vanished.

She stood at the rear of the meeting hall, behind the blockade of tables that separated the delegates from the public. Her hands shook, but otherwise she betrayed no sign of the angry turmoil that raged within her.

Poor guy, she thought. She had left him outside Hollister Auditorium with a hangdog look on his face after a fifteen-minute lecture about letting Joey go off on his own. If he was going to be a spy, then they should have been more careful about it. There was no excuse for that.

She knew what he was up to. That was why the first night Joey was gone, she had been worried, but not frightened. The second night was worse. The past two nights had been sleepless torture.

And up there, on the stage, the center of attention for the entire convention—the entire colony—was the man she knew had to be responsible.

The president of the convention slammed the gavel twice, heard a motion to adjourn, and before anyone could object, he ended the session. Chaos erupted from the floor of the meeting hall as a hundred delegates rose to speak at once. They surged forward, some to gather around their leaders, others trying to get close to Kolberg.

Suzanne joined the latter group, working her way slowly through the mass, inching her way towards the stage. She was nearly there when she caught Kolberg's eye. A chill ran through her as he looked down from where he sat, surrounded by aides and assistants who held off the press of delegates. He held up a hand to silence the man he was speaking with and beckoned to an aide.

A minute later, a woman approached Suzanne from behind the stage and escorted her down a short hallway to a small room. The furnishings were meager—a table and a few chairs. The woman told her to have a seat and wait.

In fairly short order, the door opened and Peter Kolberg entered, followed by three men. He stopped before Suzanne, introduced her to his assistants, then asked them to step outside.

"It's been some time since we last spoke, Mrs. Baxter," Kolberg said. It had, indeed. Before the colony landed, she had faced him over a commlink, suffered his intimidation and threats and stared him back down. "I'm afraid I wasn't very polite then. I should apologize."

"Yes, you should," she replied. "Tell me something. Do you really expect the colony to give you a different

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answer today from the one we gave you last year?''

''No, I think not. But I must give them the opportunity. It is a moral obligation.''

She tried not to gag at that remark. ''But what's the point?'' she asked.

''If you were in my position, you would feel the same obligation. We know what you must go through for many years to build your colony. We know what is best for you. If you had come to us fourteen years ago, we would have listened—should have listened.''

She swallowed her disgust at Kolberg's self-serving sanctimony. He wouldn't know a moral obligation if it jumped up and spit in his face.

''And how does kidnapping my son help build our colony?''

Kolberg stiffened, then frowned.

''I'm afraid I don't understand you,'' he said.

''Oh yes you do. You wouldn't bother wasting two seconds on me, let alone ten minutes if you didn't have some reason. The only one I can imagine is that you know precisely where my son is and you want to make sure that I know you do.''

''I'm sorry, Mrs. Baxter, but I thought better of you. This is, I'm afraid, completely irrational. I thought we could discuss my proposal. Apparently we cannot.''

''I'll discuss your proposal. You give me back my son tonight, or in the morning I'm going out in front of the convention and charge you with kidnapping. You can imagine what that will do to your offer this time around.''

''Mrs. Baxter, believe me when I say that we are both equally concerned with the well-being of your child. I would hate to see anything happen to him, especially in the next sixty hours or so. Don't you agree?''

Suzanne sucked in air through clenched teeth. ''You bastard,'' she spit back at him. But inside, her heart sank. He had called her bluff. She was not about to make the charges she described—not without some evidence. And she didn't doubt for one instant Peter Kolberg's thinly veiled threats against Joey.

She rose unsteadily, the breath torn from her in ragged gasps. She wanted to run away. The bastard had her son and wouldn't let him go. Kolberg just stared at her, no expression in his cold eyes, as she walked out the door and down the hall.

The floor of the meeting hall did not quiet down for more than an hour—time that Lin Palmer spent seated at his desk, feet up on the table, bewildered by the confusion. For him, the issue was simple: send the Kolbergs back to Eta Cass. What he couldn't understand was why anyone would want to let them run the world.

The reaction of the delegates ranged from Lin's bemused disbelief, to angry resentment at the audacity of the Kolbergs, to wild-eyed hope that the rest of the colony might back their grand enterprise. With his limited experience at counting votes, Lin supposed that the final tally would shake out into the same three categories.

Finally, the chairman of Lin's committee gathered his membership together out of the milling mob of delegates

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and sat them down around a few tables in a quiet corner.

The meeting was mercifully quick. Someone made a motion to approve the bylaws as amended and the article on dens as drafted by the committee. Someone else seconded the motion.

"All in favor?" asked the chairman.

A chorus of delegates answered, "Aye."

"All those opposed?"

"Nay," Lin called out.

The chairman looked down at him with bleary eyes and a disgruntled look. "Why not, Lin?"

"Because I still haven't seen what they say," he replied.

The chairman sighed as his face rearranged itself in confusion. "The motion carries eight to one. Do I hear a motion to adjourn?"

It was all over in an instant, and Lin staggered through the damp darkness of the central square towards the warm comfort of the Asgard Hotel.

SEVEN

Peter Kolberg spent Saturday in the main lodge of den Franklin, watching the convention on a remote monitor. The session began with quick action on the committee reports on bylaws, then dove head first into the immobility of long-winded, repetitive debate on the Kolberg offer.

He paced nervously for much of the day as the arguments unfolded predictably. There was little change in the discussion from a year earlier. The issue remained the same: who would decide the important policy issues of the colony? Would everyone go off in their own direction under the illusion that they were exercising their freedom, or would they unite under a strong central leadership?

No one had anything to say that was startling or new. And in many ways, the Kolbergs had insured that they would not. Suzanne Baxter was a case in point. The ignorant woman was too irrational to manipulate with ordinary means, but he had found a lever to keep her off the floor. Her interference the last time around had cost him dearly.

Instead of listening to the words, Kolberg paid attention to who was speaking. He had a fairly certain count of the delegates and the dens. He knew who was on their side and who was not. There were a few fence straddlers, dens divided among themselves over who to follow, and it would be interesting to see which way they broke. But he knew long before the vote just how things would turn out.

The delegates continued to talk through lunch and dinner, but with the supper hour approaching they began to run out of steam. A brief recess came around 2000, and the leaders put their heads together to see how they should handle the rest of the session. The den leader from Olympia called and talked for a while with Kolberg.

"Do we go on after supper, or is this as far as you want to take it?" the man asked at last.

"Everyone has had their chance to talk. Whatever votes are going to be ours are ours already. If they want to act before supper, don't stand in their way."

"Yes, sir," the den leader said.

A few minutes after that, the president hammered the convention back into

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session. And within half an hour, he called for a vote. The clerk read the resolution and rang a bell to open the voting.

Kolberg's laptop mirrored the large tally board mounted above the stage in the meeting hall. He watched as the names turned red or green from their neutral grey. It was like the screen had caught fire.

Eric Kolberg joined his brother at the last minute to see the outcome.

"It doesn't look good," he told Peter.

"No—as I expected. Out of fifty-seven dens, we've got twenty-two. Windsor split its vote, and so did Crandall. The rest of them are against us."

"And now what?"

"And now we go on with the next phase. Our opponents think they have won, but they do not know what we are fighting over. Tonight, they will celebrate another victory over us; but in a short time, we will have what we want from them." He let a rare smile crack his lips. "After all, they passed the by-laws without debate. . . ."

Joey had a test. If he could turn the two valve stems in the plumbing above his bunk into one valve stem, he was all right. If he could not, he was still sick.

Today was a one-valve day, the second so far out of the past three. Earlier than that, Joey hadn't kept an accurate count.

The ventilator fan whirred softly in the corner, the bulkhead on the far side of the compartment was in some kind of rational perspective and he could hear voices in the distance.

He recalled something of the period between being thrown in the closet with Jennie Vinh and awakening clear-headed three mornings ago. The first few hours in the closet were still a potent memory—mainly because he had relived those hours a dozen times or more in feverish nightmares. He remembered being scared for Jennie, whose little body was burning with fever. And he remembered scratching his ankles and the back of his neck where he'd been bitten by chites. When he started to get dizzy and hot with a fever of his own, he made the logical connection between the two. He remembered being pissed.

They spent the night locked in the closet. Joey was pretty sure of that, because he didn't remember being hungry in there. Sometime the next day, they moved the two of them to another room in a different part of the camp. He remembered being outside after dark, the cold air whipping across his face and bringing a temporary relief to the fever.

Then, when the delirium became serious and his body was covered with an itching rash, he discovered they had moved him again, here to what was obviously the sickbay on the scoutship from Tik.

Today the rash wasn't nearly as bad as it had been. His skin was peeling away in dry scabs from most of the places he'd rubbed raw, the itching was down to merely annoying levels, and he didn't even feel feverish.

The voices down the passageway grew louder, then closer. He realized he should take an interest in what they were saying, but he wasn't quite that conscious yet. Then he looked up at the doorway and saw a familiar face.

"Guy?"

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"Next time you try this, let someone know where you're going," he said.

"Are you for real or am I sicker than I thought?"

"As real as it gets. Can you walk or are we going to have to carry you out of here?"

"So far the most I've been able to do is see straight. I haven't tried getting vertical yet."

"I'll give you a hand."

He swung his feet out over the floor and put them down. His ankles were watery and his legs insubstantial. His face felt cold and his head swirled dizzily. Then the feeling subsided and he rose shakily until he stood erect but unclothed in the middle of the sickbay floor.

"Here's a robe," Guy said, helping guide his arms into the appropriate holes. He dropped a pair of boots on the floor and guided Joey's feet into them. "Come with me."

"This is really not recommended," said a new entrant to the sickbay. It was the nurse that Joey had recognized from his occasional moments of lucidity.

"I don't care what is really not recommended. This young fellow is going back where he belongs—today." The nurse drew back at Guy's growl. "Come on, Joey, it isn't far."

"How did you find me?"

"Later . . ."

They walked down a long passageway until they reached the amidships hatch. Guy preceded him down the ladder to the ground, lending a strong arm to keep him steady. Joey walked stiff-legged through the sand that surrounded the ship, oblivious to the cold. He noticed the crowd of people that formed a rough circle around Guy, Joey, and the truck parked under one wing of the scoutship. They were all Kolberg people, and they all glared at the two of them with piercing eyes.

When he reached the truck he saw the reason why. Standing in front of it were four scouts, all armed with hunting rifles. They carried the rifles strapped across their shoulders, but the implication was clear. Aside from the security police in the special services den, the scouts were the only ones on Asgard who regularly carried arms.

Joey looked up at Guy and rolled his eyes. Guy put a finger to his lips. The youth swallowed hard and kept his mouth closed until they were in the truck, then the four armed scouts climbed in behind them. Guy had Joey lie down on a mat on the floor and covered him with a blanket.

"Pedro Sanchez told me where you were," Guy said as they lurched into motion.

"Why did it take you so long to get here?"

"He didn't tell me until today."

"That son of a bitch. Why not?"

"Because until today, they still had Jennie Vinh."

"Jennie? How did she get back? She was sicker than me. Did she run away or what?"

"They sent her back—or rather, they sent her body back. The pox killed her."

Joey felt his stomach drop and his forehead grow cold. The air thickened, and he felt his tenuous hold on awareness slip. He let out a deep moan. Then he started to cry.

It could have been him. . . .

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They hadn't treated the two of them for the pox for three days. That was the problem, he realized. The acyclovir they'd given him when he got to the scoutship had begun working right away. But before that, the Kolbergs had just let them lie there and suffer. Guy said Jennie had been dead four days when they brought her home. The Kolbergs didn't want Sanchez to talk. When Jennie showed up, he called Lucky Levesque at den Pontiac. Lucky called Guy.

"Why? What did they do it for?"

"Politics. They tried to get us to buy their contract again. Relax, we voted it down. But I guess they figured you might screw things up."

"But how? What could I do? I was only in the office for ten minutes. I didn't see anything."

"Maybe they don't know that. Or maybe you don't know what you saw that was so important. Or maybe they're just so paranoid, they didn't want to take a chance. Your mother said they kept her quiet by threatening to send you back like Jennie."

"Damn. I guess I finally got into real trouble with her."

"If the way she yelled at me is any indication, I'd say so."

"This is screwy. Back before I got sick, I figured out that I must have stumbled across something important. They were real worried, or they would have bought my curious kid act. But the only thing I really looked at was a spreadsheet on the colonial economy, like the ones Emily's been studying. I watched it crank for a long time. I was staring at it when Peter Kolberg himself came in and caught me. I wonder if that's why they bagged me?"

"I don't know, Joey. We'll have to figure that out when we get you home. . . ."

Guy Stanger felt exhausted by the time the truck returned to Center Township. He began the trip in a terrible state and things had only gotten worse. He hadn't needed Suzanne Baxter to make him feel guilty about Joey's disappearance, he knew he'd failed. And when Pedro Sanchez came forward, his anguish had become all the sharper. It could have been Joey who came back in the bag instead of an innocent little girl.

In fact, he realized when they left the Kolberg camp, Jennie's death was even more tragic. At least Joey knew what he was doing. Her involvement was entirely accidental. Guy had spent an uncomfortable couple of hours on the way back down the rough road from den Olympia wrestling with that fact. There was no easy way to swallow it, and it was still stuck in his craw.

Their first stop was the infirmary at den Schweitzer. Joey didn't want to go, but Guy was insistent.

"Then do me a favor before you leave me here," he said. "Get me a laptop and tell them to let me talk to Emily. I want to know why the Kolberg spreadsheets were so important that they let Jennie Vinh die rather than let me go."

"Done." It took a few minutes to arrange, but Guy was insistent once again.

His next stop was the meeting hall. Guy had expected to meet Suzanne at the infirmary, but she'd left him a message to head for Hollister Auditorium and find her there. It was a short drive

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and his scout mates dropped him off in front of the main entrance.

The street was empty, but the doors were open. He stepped through them to find a wall of backs bracing the chamber. Up on the stage, above the crowd, stood Peter Kolberg addressing the convention for the second time in a week.

". . . But since you chose not to accept our offer, we have decided to take a different course. After looking at the bylaws adopted by the convention, we have chosen to make a contribution to the Asgard colony in another way. Mr. President, convention delegates, I wish today to announce formation of a new den, which claims entitlement to all the rights and benefits accorded to the dens of the Asgard colony under the bylaws of this convention.

"The membership of this new den includes permanent colonists from Tikarahisat who have decided to settle here on Asgard, scouts from den Iroquois with holdings on Asgard, and colonists from the dens that arrived here one year ago and who have decided to join us.

"It will call itself den Kolberg.

"We want the people of Asgard to know that our commitment to this world is strong and real. We plan to stay among you for a long time. I present to you now a list of the families who will comprise den Kolberg."

Guy listened to the roster with half an ear. He didn't recognize most of them. The scouts Mike Hennig and Henry Schmidt were the exceptions. But what was interesting was the sudden flurry of outrage that erupted among small groups of delegates at the mention of the names.

"There you are."

Suzanne Baxter appeared at the edge of the crowd. "How's Joey?"

"He's fine. They've been treating him with acyclovir for three or four days up there. No more fever. The rash is drying up."

"He sounds better off than we are in here," she said with a frown.

"I know. Can they do this?"

"I guess so. Harry Bayard told me this morning that according to the bylaws, until there's a government on Asgard the convention decides whether to recognize new dens."

"Since when?"

"Since Saturday morning. Harry said the Kolberg supporters slipped the rules through when everyone was preoccupied with their contract offer. I wonder if the whole thing was just a big bluff, a diversion to set us up for this."

"Can't we just change the rules?"

"And start off our new government with a clearly unjust and dishonorable act on our record? The rules are fair as they stand. If we don't have a government in place before the first follow-on dens arrive, someone's got to grant them legal status. We can't change them just to stop the Kolbergs. We've got to do more than that."

"Like what?"

"I don't know."

"And why do they want to start a den of their own?"

Suzanne closed her eyes and shook her head. "Again—I don't know."

EIGHT

"Emily, what does SAO 22341 mean?"

Joey's sister looked up from her own

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laptop, which was busy relaying information to his. "I don't know, what does it mean?"

"I asked you first. I don't know what it means."

"Well, neither do I. What difference does it make?"

Emily had worn a sour expression since arriving at the infirmary shortly after dinner. When Guy left, he said he'd "arranged" to get him a laptop and his sister's spreadsheets. What he didn't say was that Emily was going to bring them with her. And Joey could tell that Em was not happy with drawing nursemaid duty, either.

Ordinarily he would have ignored her, but after a week of pox and imprisonment, he was glad to see a familiar face, even his sister's. So he tried to be polite. It wasn't easy.

"Calm down," he said, which only made her more angry. "It's just something I remembered from the Kolberg spreadsheet. You don't have it on yours."

"Doesn't ring any bells for me. Maybe it's a special account. Special Accounting Order . . . Solar Adjusted Objects . . . Stupid Arrogant Obnoxious . . . I don't know. What part of the sheet was it in? Do you remember anything about the numbers? What did the spreadsheet look like?"

Joey closed his eyes and tried to revive the fever-strained memory. "The whole sheet was in Earth-Solar years. One interaction every year. Production figures, labor and capital growth, expenditures, industrial output, research, investment, return on investment, capital borrowing, capital repayment, capital export—that's the column where I came across SAO 22341."

"Capital export? That's an odd category. I don't have it on my sheets. Are we talking big megabucks or was this some marginal item?"

"Small numbers, small percentage of GPP, when it kicks in about eighty years from now. But it starts to balloon after a century or so."

"I still haven't got a clue."

"You know, Em, there's another thing about their numbers that are different from yours. Yours are all kind of flat. But theirs have some kind of cycle going that gives the system a boost every twelve years. Why doesn't your spreadsheet do that?"

"I don't know, Joey."

"You're no help."

"Don't get wise with me, little brother."

"Where are my clothes?"

"In the locker over—what are you planning to do, kid?"

"We've got to go talk to somebody who knows something. Where's Guy?" Joey swung his legs out over the edge of the high hospital bed and slipped onto the floor. He felt shaky, but alive. Everything worked well enough, he decided. The locker in the corner held a clean pair of trousers and a shirt, his hiking boots and clean socks.

"What, no underwear?"

"I wasn't going to go digging in your locker looking for your underwear. Your socks were bad enough."

"Everything's clean, Em."

"They're not going to let you out of here, you know."

"Then we'd better not ask them if it's all right. You bring the laptops, I'm going out this way."

He pushed the table up against the

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wall below the window and climbed on top. A minute later he had dismantled the latch and climbed through.

"Meet me around the front of the building. And where is Guy?"

"Joey, you're going to get me in trouble. Guy is over at the convention—with Mother. And I wish I was there with them."

The conference room at the Asgard Hotel was small and sparsely furnished—a rough wooden table with a couple of laptops set up on it, benches and a few chairs occupied by delegates from the convention. A partially polarized window without curtains looked out onto the square. From where he sat, Guy could see the meeting hall across the commons, with delegates and staffers milling about the entrance.

The debate had come to a standstill over there, and the president had called a recess. Suzanne's political allies had called a strategy meeting. They clustered around the table now, trying to divine the twisted paths of Peter Kolberg's thought. They were not having much luck.

Guy recognized Harry Bayard, but the others were new faces to him— including Lin Palmer, the farmer from den Aroostook, and Betty Montgomery from den Cornwall.

"I still don't understand Suzanne's argument against changing the rules," Lin said. "It seems the most direct route to me."

Harry Bayard ran a hand through his white hair and wrinkled his brow. "It's a matter of pride, personal honor, and precedent, Lin. You'd be asking the delegates to admit that they made a mistake, that they weren't paying attention. And the rules are not out of line. All they did was make the convention responsible for creating new dens. It's obvious now that they did it so they could be the first to apply—but the rule itself makes sense. You might get the convention to swallow the rat and rescind the rule if it was a clunker, but not if it's legitimate. Besides, it would make them look like they were ducking the most important question the colony's going to face for the next hundred years: What do we do with the colonists who come after us?"

"But those are legitimate colonists," Lin said.

"So are the Kolbergs. Just because they don't come from Earth doesn't mean they don't count. And they've got people on their membership list who did come from Earth. Some of them on the same ship as you, Lin."

"OK, we don't change the rules. Can't we get them to vote against the Kolbergs?"

"I don't see how. They meet all our standards. That's what law is all about. It's supposed to be the same for everyone."

"And what do they get out of it?"

"Two seats in the convention. The right to vote in the new government. What else?"

"A township," said Betty.

"Rations, capital, and labor entitlements," said Harry.

"A foothold on Asgard," said Suzanne. "And that's what they've wanted all along. That's why they didn't put up a bigger fuss over the management deal. If they were serious about that, they would have fought us tooth and nail.

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Instead, they trotted it out, went through the motions, and told us to phone in our answer over the net. Not what I'd call a hard sell."

"They didn't even get all their own people to vote for the deal," Harry noted.

"Because they didn't care," Suzanne said. "They had this waiting in the wings. Guy told us about the scouts that joined them last month. We should have realized this was coming. It's all part of a larger plan. Does everyone else see that, or am I just getting paranoid in my middle age?"

"I see it," said Lin. "They've got a shopping list and what scares me is that I'm on it."

"But that brings us back to the question that we haven't been able to answer from the day we arrived at Asgard," Suzanne said. "Why did the Kolbergs travel across six light-years of cold space just to start a den on Asgard? What is in this for them?"

Guy shook his head. In six months, no one had been able to advance a single centimeter beyond that question. All the spying by Joey, all the analysis by Emily, all the questioning by Guy himself had not produced an answer. The isolated, meaningless facts kept up a slow, measured dance around Guy's head, keeping pace to some unmeasured beat, centered on some unknown guide. Peter Kolberg knew what he was up to. He had a plan and an agenda and a schedule, and he was keeping to it.

What galled Guy the most was that the man had kept all knowledge of that plan away from him, from his friends and family and from the colonists of Asgard.

A knock came at the door.

The men and women at the table continued their fruitless discussion while Guy rose to answer it. He opened the door and there was Emily, a laptop under each arm, her little brother beside her. He looked back over his shoulder at the meeting and decided quickly to steer them the other way. He stepped out into the hall and closed the door behind him.

"Don't tell me that neither of you knows anything about astrography," Guy said as he led them across the street to the broad square of close-cut savannah grass. He had taken them outside to avoid the close and anything-but-confidential political atmosphere within the hotel. Out here, he could have all the privacy he wanted and could see anyone coming who might invade that privacy.

"Don't look at me," said Emily. "I'm majoring in social sciences, not physical sciences."

They both turned to Joey, who shrugged. "The numbers in astrography are too boring. They never change. Come on, Guy, I'm a math wizard, not a science drone."

Guy shook his head in amazement. It was so simple, he couldn't believe that they didn't know the answer.

"SAO stands for Smithsonian Astrophysical Observatory. It's a designation for stars, part of their names. SAO 22341 is the next star out from here—about fourteen light-years farther out from Eta Cass. They call the major habitable planet there Helvetica—ever hear of that?"

Joey shook his head, but Emily's eyes

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showed a flash of recognition. "There's already a scout team there, isn't there?"

"As far as we know, there is. They would have sent their report back to Earth by now, I think. But there won't be a breakthrough colony there for another eighty years."

"Bingo!" said Joey.

"What did I say?"

"That's when Kolbergs start exporting capital," Joey replied.

Emily's face was twisted by a puzzled frown. "That doesn't make sense."

"Why not?"

"Because it sounds like the Kolbergs are trying to set up an interstellar trade syndicate. Only with the soliton drive, you can't travel faster than the speed of light. And that means you can't carry on any kind of meaningful trade between the stars."

"I don't see why not," said Joey.

"Because it takes six years to get to Eta Cass from here and six years to get back. What kind of business is going to wait that long to fill an order, or get paid for a product? What kind of products are they going to ship that would make it worth the wait? What if the money isn't worth anything by the time it gets there? It doesn't make sense. People have talked about it for years, and they all came to the same conclusion—we're out here on our own."

"And yet the Kolbergs seem to be busy trying to do what you claim is impossible," Guy said. "Maybe they've figured out something that everyone else has missed. After all, we are only the second colony in this sector."

"I don't know, Guy. But economies and financial systems can't operate with that kind of a time lag between actions. There's no interstellar market for agricultural products. We won't be producing industrial goods for a long time. And there's no way to respond to short-term changes. What good would it do them if they all grow old and die before they get a return on their investment?"

"It beats me," said Guy. "But Joey saw what he saw. It sounds like they're making plans for something big. Maybe we just haven't figured out exactly what they're up to. Maybe it's bigger than we can imagine."

"Yeah, and maybe they're going to turn into Easter bunnies and give us all presents," said Emily.

"Come on, Em," Joey said. "Guy's right. We've only been thinking about this for a few minutes. The Kolbergs have been working on it for years."

"Well until you get them to explain it to you, we're still just as bad off as ever," Emily said. "Even if they do explain it, I don't see how it can affect what's happening here and now. The real problem is that the Kolbergs want their own den. What are we going to do about that?"

"The way they were talking when you showed up, there isn't a single thing we can do about it. The rules are fair, the Kolbergs are within their rights, and the convention is probably going to give them what they want."

With that statement, a palpable gloom fell upon all three of them as if the sun had dipped below Mount Thor in the west.

NINE

The light from Rudy gave a bloody tint to the cool fog that condensed out

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of the moist evening air, suiting Guy's dark mood. He walked without direction in a world where sound and light alike were swallowed up before they had traveled more than a few meters.

His feet carried him along, but his mind was elsewhere. Olympia Township, where Jennie Vinh had breathed her last, a scared captive of ruthless and insensitive men. Den Franklin, where her family lit mourning candles and chanted prayers for her spirit.

His face and hands grew wet as he swept droplets from the fog in his relentless march through the void. He had no place to go, but walked to give motion to his thoughts. And no matter which way he tried to turn, they kept returning to Jennie Vinh. Her cold, waxy face and her guiltless cry hovered in his imagination. Never mind that he had never met the girl. He would never forget her for as long as he lived.

He had killed her just as surely as the Kolbergs had. And just as surely as Joey Baxter had.

So much had happened in the year since Guy led a patrol of young scouts up to Glacier Valley and saw the Kolberg miniplanes gliding through the night, so much that could never be undone.

Back then, before Colony Day, before the arrival of the Kolbergs, he had dreamed innocently of a bright new future for Asgard. One where the colonists would settle the valleys of Prime Site and the scouts would lead the way into the wilderness, where man and nature would live in peace and harmony.

But it seemed like every time he turned around, his world took another step away from that dream. The Kolbergs had turned the colonists against one another. Emily's stepfather was killed in a scoutship crash. The fuzzasaurs narrowly avoided wholesale slaughter. The scout den broke up. And now this—Jennie Vinh and the Kolbergs's bid to make a new den.

Until this last, he had met each crisis with an unbroken optimism, certain that somehow, things would work out. But not now. He knew at last that the future he had envisioned was only a dream. Real life was much more difficult, more complex, and more disappointing than he had ever imagined. The harmony that he had hoped for was a thing of the past, a creation of the scouts, who had since lost even their own unity. The future was going to be a struggle, long and endless, between the different urges of the colonists—hope and fear, sacrifice and selfishness, freedom and empire.

It was not what he had prepared himself for in all the long days and short years of his youth. It was not what he wanted for himself and his own children.

But then, he did not recall ever being asked what he wanted.

After walking the streets for nearly an hour, somehow Guy found himself standing in front of a familiar storefront—the Silver Rose, the ale shop he had visited a few nights earlier looking for information on the Kolbergs. He wondered how had he ended up there. Then he was struck by a sudden inspiration, which sent him into motion once again, stepping from the fog into the warmth and soft light of the tavern.

"Talk to me, Mike. Tell me about

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interstellar empires. Tell me about the Kolbergs."

At first, Mike Hennig didn't notice Guy. His heavy-lidded eyes struggled to open and focus and his mouth worked around words he could not speak. Then he shuddered once and came alive.

"You again? What do you want this time?"

"Knowledge. I want you to tell me what you know. Explain to me how the Kolbergs are going to build an interstellar empire."

Mike laughed and rubbed his eyes with the backs of hands. "You've figured that much out already, have you? And you can't make sense of the rest, I'll bet. Neither could I—at first."

"I know what they say about the idea. It takes too long to do business. Investments don't pay off for decades. By the time you catch your mistakes, everyone involved is dead and gone."

"Sounds depressing. I don't think I want to join. Actually, we've got a better idea. And I'll bet you couldn't figure it out in a thousand years, because you won't have that long. But we will. . . ."

That prompted another round of self-satisfied laughter that left Mike's face red and his eyes full of tears.

"If you don't want to tell me, fine. But I just want you to know what kind of devils you're getting mixed up with. Last week, they let a little girl from den Franklin die of mud pox just to keep the secret. Is that what you bought when you traded in your landholdings? What kind of a scout do you call yourself now?"

Mike's face fell, frozen suddenly with anger.

"You fight dirty, little ripper. What makes you think I don't care what the Kolbergs are like? I'll tell you their secret, but first I want to pull you down off your high horse. You look down on me because I left the den. But when are you going to admit that you're not a scout anymore? You do the work of the colonists—and I've seen you with your colonist girl. You're no more a scout than I am. None of us are."

Guy swallowed hard and tried to ignore the anger that was rising within him. He bit his tongue and let Mike continue.

"The Kolbergs aren't talking about making us rich, you know. They've got a bigger bait than that. Tell me, kid, how would you like to live for a thousand years? That's what they asked me. I don't mean live a lifetime of centuries, but how would you like to skip across the decades like stone on the water. Pause here and there for a few months, then move on. Watch the colony grow and develop from this little camp to big cities and great nations. How does that sound for a future?

"All you have to do is climb aboard a starship and take the step across the stars. Ten years gone in the blink of an eye. Another ten and you're back. Keep it up for a few months, and a century is gone. All the people you left behind have died, new ones have taken their place. The colony has millions of people by then. And by then, the investments have paid off, the mistakes have been corrected, and business is booming.

"Interstellar trade doesn't take long as far as the traders are concerned. The deals may take twenty years to work out, but if you're not around for most of that time, who cares? Let them take

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forty years if they have to. As long as there's someone around to keep an eye on things from year to year, it'll work out in the long run. And we're in it for the long run. While you travel, your bankbook stays home. You build up interest and dividends and equity. After a few centuries, we're talking about real leverage—that's the word the Kolbergs use for it.

"The rest of you people can stay behind, live your lives one day at a time. Den Kolberg is going places—literally. And I'm going with them. I'm with Peter. This was all his idea, you know, his special vision. He was a dirt farmer, just like half the colonists here. Only he couldn't stand the idea of spending his life digging in the dirt to make a colony that wouldn't mature until long after he died. He wanted to see it grow and thrive.

"He knew how to do it, too. Just start traveling. Asgard first. Then Helvetica. Pericles. Poseidon. The whole Perseus Sector is going to be opening up over the next century. You groundlings will never see it, but the rest of us will be there, building a future for ourselves. You'll all be dust in the ground by then. And then what difference will it make who belonged to the scout den back in the old days?"

He sneered, then let his head drop back. Guy twisted his face in anger and disbelief, then stood up from the table and fled the tavern, running from a truth too terrible to know.

A cool breeze had cleared the fog from the central square, leaving the air dry and crystal clear, the lights from the shops and eateries burning bright and crisp. Guy felt the grit in his boots, and his mouth was full of the taste of metal as he walked back to the hotel.

The Kolbergs were going to get away.

They were going to wrap up their business, then run, up into the sky, up the time line, into a future that would become increasingly their private property. The harder the colonists worked, the richer the Kolbergs would become. Each year that went by would bring them more wealth and more power. Each time they returned, they would be a bigger and more formidable threat. But most of all, the thing that ate at his soul was the idea that they were going to escape. All that they had done or were going to do, they would never have to pay for. No matter what the crime, no matter what the injustice, they would be able to skip across the decades and skip out on the blame, the guilt, and the payment.

But at the same time, Guy felt alive and free in a way that was beyond his understanding. For six months, he had lived with a sense of terrible foreboding. It had churned away slowly but constantly in the back of his mind, underlying all his joys and pleasures.

Now the churning had stopped.

The evil had revealed itself. It had chosen the form it would keep for generations. Guy felt as if a terrible burden had been lifted from his shoulders. A Kolberg den certainly would be frightening in all of its implications, but it was not nearly as bad as the blind fear that had lurked in the dark corners of his soul for a year now.

This, at least, was something he could face. It was something he could fight against and maybe even defeat—although

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that was still just a vagrant, unsubstantiated dream. Now the threat was a known quantity, with weaknesses as well as strengths.

And slowly, as he padded across the dew-covered savannah grass, he began to sense a new strength within himself. All the changes of the past year had reached their peak. All the uncertainty had ended. The future was no longer a clouded landscape, cloaked in red shadows as if lit by Rudy. It was a bright valley, where danger could be seen, but avoided.

A smile broke across his face as he looked within himself and saw the man that he had become. He knew at last that he finally had both the strength and the knowledge that he needed.

Damn the Kolbergs! They would not rob him of his life. They would not take away his world. He vowed not to let them. And he knew that he had the power to fulfill that vow. . . .

When he got to the hotel, he found the conference room empty. He paced around the table, full of nervous energy, looking for a note or a message to tell him what had happened. There was nothing there.

He was about to leave when the door opened, and Emily walked in.

"There you are," she said. "Mother's been looking all over for you. They're back in session and ready to vote. Guy, they're going to let the Kolbergs form a den."

"I know, Em. But that's only half of it. This is just the beginning for them."

"Come on, quick. Mother wants you over at the meeting hall."

He took the lead as they hurried from the conference room, down the stairs and out the front door. Emily had to run to keep up with him, and by the time they reached Hollister Auditorium, she was out of breath. They found Suzanne Baxter waiting inside the main entrance. She looked tired, tense, and unhappy.

Guy went to talk to her, but before he could say anything she took him through a side door and into a cloak room where they could be alone. When the door was closed behind them and their privacy was assured, he told her what he had learned from Mike Hennig.

She took it with the same sense of calm strength that Guy had discovered on his walk across the square.

"Everything they did was a charade," she said. "All of it, right from the beginning. The management offer, the business deals, the labor bonds. They were just paper tigers to keep us busy while they worked on the only important goal. Once they get that den, they are part of Asgard forever."

"I don't know if it was all a front. I think they were serious about most of it. They would have been just as happy if we had agreed to let them run things."

"But it never mattered to them, Guy. They've outmaneuvered us. We never even had a chance."

"We do now. Now that we know what they're really doing, we can stop them."

"No we can't, Guy. It's all over. They're going to vote in a few minutes, and the Kolbergs are going to get everything they want."

"You're wrong, Suzanne. Once they get their den, the Kolbergs are going to be gone. They may leave their friends behind to keep an eye on their business,

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but they won't be here to take care of things themselves. And we will. We'll be here every day, working to keep them from getting their hands on the rest of the colony. When they come back, we will have had twenty years to get ready for them."

Suzanne sighed. For a moment, Guy thought she was going to cry. All the weight and pain of the events of the past year showed in her tired eyes and deeply etched features. Then a spark of light flashed to life in those eyes and a smile blossomed across her face.

"Guy, you're so young and full of strength. You think you can do anything, don't you?"

"Why not, Suzanne? We're not going anywhere. They are. Don't tell me you can't think of something to tell that convention in there. I remember the night you talked the whole colony down out of the sky."

Guy's heart pounded with excitement as he watched Suzanne stiffen her back with sudden resolve and flex her arms with a new energy. Her eyes glazed briefly as she mumbled to herself: "I suppose I could warn them about the wolves."

TEN

The voting had already begun when Guy and Suzanne entered the hall. A big datascreen at the side of the chamber revealed the tally. Suzanne drew in a breath at the sight of it. To the untutored eye, it looked like the red blots outshined the green. But she knew that was just an optical illusion.

She could tell that the resolution was headed for approval. A quick check of the votes that remained uncast bore out her fear. The anti-Kolberg faction had already taken its stand, as had the Kolberg supporters. The holdouts were the uncommitted delegates, most of whom had already expressed their reluctant support for the measure. They said they wanted to be fair.

Fair, my elbow, she'd told herself when those wishy-washy slackers made their whining pleas. They were the kind who would argue that being fair meant punishing all children for the misbehavior of one.

She could understand why they were waiting until the last minute to take a stand.

But eventually the time came to close the tally board. The president asked three times if all the delegates had voted. When he finally slammed the gavel down, six delegates still remained silent.

"Those voting aye, sixty-six, those voting nay, forty-six, those present and not voting, six," the president of the convention announced. "The motion is adopted!"

The hall filled with boos and cheers as the delegates rose from their seats. About a third of the delegates stayed put, turning their eyes away from the rest—they did not like the Kolberg backers and they could not face the others.

"The convention will stand at ease for a moment," the president said, his voice barely audible above the din of rancorous conversation.

Suzanne gathered her wits about her. She had spent too much time feeling sorry for herself, she realized. There was a time for mourning and a time for action. The trick was knowing the dif-

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ference. She hadn't wanted to get involved in the struggle. Her feelings were still raw over the loss of Ray. And a week of worrying about Joseph had left her drained and exhausted.

But the sight of Guy and Emily, arms locked around one another, standing defiantly at the rear of the hall despite the victory of the Kolbergs, changed all that. What brave young kids they were. They were better off in their innocence, not knowing what the future was likely to hold.

But she had seen a change come over Guy in the past few days. Something had settled in the young man, some kind of resolve had seized him. Especially tonight. He was no longer the reticent youth who had first led her pathfinder team up the Scout Path to Glacier Valley.

And his newfound strength was contagious, she realized. How else could she explain the boldness that now carried her forward through the mass of delegates to find Harry Bayard.

He was surrounded by a circle of his closest allies. None of them looked happy. Maybe she could change that. . . .

"Harry, I want to talk to the convention," she said, raising her voice to be heard over the ragged roar of the delegates.

"God, Suzanne, what do you want to do that for? They're so riled up now, they'll eat you alive."

"I don't care. I have something to say to them. Maybe it'll settle things down. At the worst, it'll give them someone to be mad at besides you."

Harry shook his head and shrugged. "If you're sure you want to do this, I'll set it up."

"I'm sure, Harry. Real sure."

It was fifteen minutes before some semblance of order was restored to the convention. Noise still filled the chamber though, and the president had to pound on the gavel several times to silence the delegates. Then he introduced Suzanne.

She was seized with a moment of disorienting panic as she rose to her feet and took her place behind the podium. But it passed as quickly as it arose when she began to speak.

"You know, friends, even though it's only been six months long, this has been the longest year of my life. I don't know about you, but I'm glad it's over. Tonight, you've all settled the biggest question that's been hanging over us since before we landed on Asgard. Some of us don't like what's been done, but it's been done, and the issue has been settled. Let me be the first one to welcome den Kolberg to Asgard."

She saw the puzzled looks on the faces of Harry Bayard and Betty Montgomery and the rest of her friends, as well as the confusion among the Kolberg supporters. As she heard the buzz of approval from the uncommitted delegates.

When she stood up, Suzanne had planned to deliver a stern lecture to the delegates. She was going to tell them about predators and the threat that a Kolberg den was going to pose for the colony. She was going to ask the convention to impose strict limits on how much of the colony the Kolbergs would be allowed to own. She was going to

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be tough and demanding and uncompromising.

But suddenly all that had become impossible.

"The Kolbergs have been trying to find a role in our society for a year now. While the proposals they've made haven't been acceptable to us, we are all glad that they've finally found a place in the colony. I recognize that a good many of you delegates who have voted against the Kolbergs in the past felt, out of fairness, that this is the best way to go."

The delegates in the middle were the reason why it was impossible. She realized that if she said anything at all critical about the Kolbergs tonight, it would only alienate them. They wouldn't see the Kolbergs as the target, but themselves for voting for them. And if she wanted to be successful in her efforts to put a leash on den Kolberg, she would need their support.

No, the best thing to do was to follow the lead of the Kolbergs themselves. Be discreet and invisible in public. Go through the motions of conciliation and consensus, and then come back when all that was done and take care of the real business.

The alternative was to preach to people already exhausted by making a decision they did not like. All she could accomplish by that would be to drive the majority of them away. Later, when they were rested and had had time to think, they could discuss it rationally. There would be time. Lots of time.

"Now the time has come to start the real work of forming a government for this planet. There are a lot of important decisions for you to make. Now that this has been settled, let's hope we can all get along for the good of the future of Asgard. Thank you and good night."

She looked out at Guy and Emily, their hands still linked. Joey sat on the table beside them, pale but alive and whole. She smiled and felt strong. Closer to the stage, Harry Bayard shook his head in disbelief while the delegates looked towards him with uncertain eyes.

She would have to explain to them later, after the applause died down and the convention had adjourned and the delegates drifted away.

Guy and Emily made their way back across the green to the Asgard Hotel and waited in the upstairs meeting room as the delegates returned one by one. Harry Bayard and Suzanne were the last to arrive. By then, the rest of them, Betty Montgomery, Lin Palmer, and a dozen others, had filed in, all grumbling and complaining to various degrees about the outcome of the vote. They all shared a bewilderment over Suzanne's closing remarks.

Emily sat beside Guy on the bench, resting her head on his shoulder. Joey sat with a laptop on the table, running through spreadsheets and calculations. Guy was exhausted, his mind a blank. He wasn't sure what Suzanne had been trying to do, but it wasn't what he had expected.

When she finally entered the room, everyone fell upon her, surrounding her with anxious faces and pelting her with their questions.

Guy slipped away from Emily and pushed through to help her into the room and to a chair. "I thought you were

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going to warn them about the wolves," he said.

She smiled weakly and said: "So did I."

Harry quieted the room by filling it with his own voice. "Everyone calm down and be patient. Suzanne wants to talk."

Emily came up to Guy's side while the delegates found seats or took up stations against the wall. He took her hand and gave it a squeeze, which she returned.

"I'm sorry, everyone," she said. "I went up there with every intention of giving the convention hell for what it did tonight, but when I saw their faces, I realized that was the wrong thing to do. I couldn't change anyone's mind tonight, and I didn't want to undermine the job that we're going to have to do—starting tomorrow."

That didn't seem to satisfy the delegates, Guy thought, who shifted uncomfortably in their places. But she wasn't finished.

"I want everyone here in this room to know that what I said to the convention is for public consumption only. What I was going to say up on that stage I will pass along to you now. At least you're willing to listen.

"This is an important time for the human race. It is the fate of humanity to be rootless in the Universe. We have never remained at home for long and our history is one of a long series of migration—across continents and oceans and now across the emptiness of interstellar space. On all our previous migrations, we have had to contend with new environments and old threats.

"For a while, when we first arrived here on Asgard, I thought this migration would be different from the earlier ones. I thought we would be free of the predators that followed the race in its previous wanderings—natural predators like the wolf. But I know now that I was wrong.

"We have invented our own predators—or rather they have invented themselves. Tonight, we have allowed the creation of a den of wolves, which will follow us through the generations as we expand into the stars.

"And as we have done in the past, we are going to have to protect ourselves from these predators. Now we must build fences to keep them from our children and our land. This convention will not complete its work until there are restrictions on what den Kolberg and its friends can do. There have to be limits placed on their holdings, controls placed on their wealth. They have plans for our world that do not include us—plans that will take generations to complete.

"It is up to you to stop these self-made predators from turning us into their sheep. It is up to you to save our world from this den of thieves and wolves. . . ."

Suzanne fell silent and there was a moment of quiet among the delegates. Then Harry Bayard stood up and started clapping. The others joined him, and the applause was overtaken by a rising wave of voices, all echoing Suzanne's words and promising their support.

A long time later, after everyone had wound down from the night's drama and the conversations had become muted and private, Suzanne came to Guy and Emily, with Joey in tow.

Guy looked into her eyes and saw his

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own newfound resolve reflected in them. Joey's eyes, on the other hand, were red and heavy. His bout with the mud pox was not quite over.

"How are you two tonight?" Suzanne asked.

"Tired, angry, and determined," Guy replied.

"Good. Never mind what I told the rest of these people tonight. The real struggle isn't going to be here at the convention. It's going to be out there in the townships and the dens. It's not going to end for a long, long time. You're going to have to live with it—and so are your children and grandchildren and many generations to come after them."

Guy smiled suddenly at the mention of his children and grandchildren, theoretical as they might be at present. In an instant, his mind's eye caught a vision of a long and unbroken future stretching forward from this moment. All the long march of history was turned end for end and continued on through time. He and Emily, their children and grandchildren, and all that would follow, they were all there—as were the Kolbergs, locked with them in a millenial struggle that could afford no defeat.

"Are you ready for that, Guy?"

"We're ready," he said, his heart swelling within his chest.

"Both of us, Mother," Emily said, hugging Guy. Then she took Joey's hand in hers and added: "All of us." ■

Classifieds

by Mike Resnick

From the Classified section of the *Antares Gazette*, October 47, 2771 A.D.:

REAL ESTATE:

FIXER-UPPER! War-torn planet for sale. All major continents in place, unobtrusive bomb craters can be easily landscaped with minimal terraforming. Habitable again in 3822 A.D. All utilities included. Asking 35 million credits. Motivated seller. Write Cjsonti the Destroyer, Box 1013.

IDYLLIC DESERT ISLAND, available on a time-sharing basis. Grundach trees galore, prize-winning methagulum flowers, grow your own *pilchhh*. Chlorine-breathers only. Price 200,000 kwechners, firm. Box 23.

PRICE REDUCED! Yes, the grand old McWhipple Estate on beautiful New Graustark is once again on the market. Own your very own castle, complete with towers, minarets, 3 guest houses, barn, and a brand new cemetary—and this time we *guarantee* that there are no traces of plague bacillus remaining. Write for our new price! Box 666.

ARCTURANS: Is brooding time approaching? Are you unprepared for 25,000 new offspring in the nursery? Will their lovable, sluglike little bodies all fit in your dining room? Why not consider the Carlsbad Caverns? Short or long-term leases available. Brochure upon request. Contact US Dept. of the Interior, Box 7168.

TRAVEL AND VACATIONS:

TIRED of the usual safari? Sick of shooting at game that wants only to escape? Looking for the kind of excitement that you thought had vanished forever? Then contact *Macho, Unlimited*. We hunt horndevils on Alpha Bodani III, killerowls on Far Madrid, and Kiwanis and Freemasons on Earth. Down payment required. Box Uno.

COME VISIT Ichtyos Estates, at a depth of from 10 to 200 feet in clear, unpolluted water, where the temperature is always 17° centigrade. See what our chefs can do with 83 varieties of sea-

(continued on page 252)

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THE ANALYTICAL LABORATORY

The authors, artists, and all of us on the editorial staff thank you once again for your votes in our annual poll on the previous year's issues. This is the most meaningful way I know for you to convey your appreciation to those who do an especially good job of entertaining you, and the more votes we get, the more meaningful it is.

The feedback your votes provides also helps *you,* by giving us a better feel for what you do and don't like. That way we'll have a better idea of what to offer you in the future.

To review the procedure, we have four categories: novellas and novelettes (one category), short stories, fact articles, and covers. In each category, we asked you to list your three favorite items, in descending order of preference. Each first place vote counts as three points, second place two, and third place one. The total number of points for each item is divided by the maximum it *could* have received (if everyone had ranked it #1) and multiplied by 10. The result is the score listed below, on a scale of 0 (nobody voted for it) to 10 (everybody ranked it first). In practice, scores run lower in categories with many entries than in those with only a few. For comparison, I've included in parentheses at the head of each category the score every item would have received had all been equally popular.

NOVELLAS AND NOVELETTES (0.43)

1. "Weatherman," Lois McMaster Bujold (3.01)
2. "Shaman," Maya Kaathryn Bohnhoff (1.26)
3. "Naught for Hire," John E. Stith (1.17)
4. "Funnel Hawk," Tom Ligon (1.08)
5. "The Hornless Ones," Paul Ash (1.06)

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SHORT STORIES (0.51)

1. "VRM-547," W.R. Thompson (2.04)
2. (tie) "To Victor Go the Spoils," Grey Rollins (1.16)
   "Godspeed," Charles Sheffield (1.16)
3. "To Tame a Tiger," Mary Caraker (1.13)
4. (tie) "Look Closer," Amy Bechtel (0.90)
   "The Double Spiral Staircase," Charles Sheffield (0.90)
5. "The Feeders," Michael F. Flynn (0.83)

FACT ARTICLES (1.54)

1. "Sixty Astounding Years," Michael F. Flynn (2.50)
2. (tie) "New Hopes for a Very Old Disease: Cancer Therapies for the 1990s," Dr. Kevin J. Steele (2.40)
   "Where Buffalo Roam . . .," John and Mary Gribbin (2.40)
3. (tie) "Scientific Diversions," Margaret L. Silbar (1.59)
   "Nuclear Rocketry Using Indigenous Propellants: The Key to the Solar System," Robert M. Zubrin (1.59)
4. "Taking the Shuttle to the Moon," Chris Vuille, Ph.D. (1.36)
5. "Fire, Brimstone—and Maybe Life?," Stephen L. Gillett, Ph.D. (1.31)

COVERS (1.54)

1. December: Vincent Di Fate, for "Glorystar" (2.81)
2. January: Kelly Freas, for the Sixtieth Anniversary Issue (2.74)
3. Mid-December: Nicholas Jainschigg, for "Shaman" (2.44)
4. August: Todd Cameron Hamilton, for "The Hornless Ones" (2.06)
5. June: Vincent Di Fate, for "Funnel Hawk" (1.87)

This year we had several ties, two in each of two categories; in these cases we've listed the top five scores, even though that meant more than five items. Competition was very tight at the top among covers and fact articles, while each of the fiction categories had a runaway winner followed by a pack of rather closely grouped runners-up. I was pleasantly surprised to see a good showing of *funny* stories among the highly placed stories, since it has often seemed to me that those too seldom receive the recognition they deserve, in this or any other awards program.

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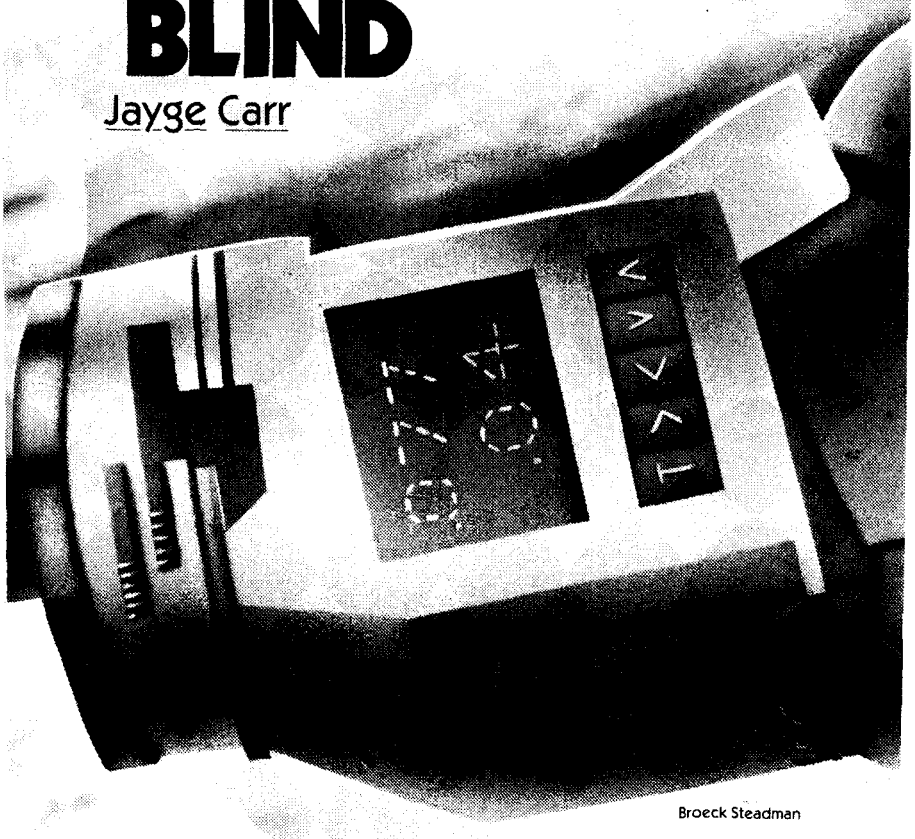
Ever wonder what lab animals think about as they're being studied?

THE KINGDOM OF THE BLIND

Jayge Carr



Broeck Steadman

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It was a landscape out of nightmares, where every step was an effort, plowed through a sucking, sink-to-the-ankles ooze that was "surface" only by definition, forced against a vicious, viscous atmosphere that impeded and clung—

Where visibility was always zero, huge black shapes menacing in almost total blackness—

Where silence was eternal, except for a crew member's own pulse and a low, through the skin throb that might have been a world's heart beat—

A brooding world, menacing, repelling, silent—

Enigmatic . . . irresistible . . .

"We need this world." Pyotr tried to keep the pleading out of his voice, as he glanced at the other five people in the cramped, console-lined room that was the largest open space in the small scout-ship, and hence the only place where the full crew could meet.

"Frackle," Diamond drawled, her cold face as hard as her name. "Let's dump it, and let someone else come and waste time and energy on it."

Mandalay, the scout's captain, whip lean and whip tough, rose slowly to her impressive 1.8 meter height and said grimly, "Humans," a glare. "Never concede anything to the muck-lickers."

Genius (Jess) and Geniality (Lee), the clone/pair herms, froze with their cups of kaffen at identical distances from identical, partly-opened lips.

Only Brown, sixth member of the crew, eyes slightly glazed as he absorbed monitoring data through the electronic leech inputting just over his ear, didn't seem to realize the sudden tension.

"Dredge-dump," Diamond snapped. "I am not talking concessions or any other high-sounding frackle. The word is practicality. Prac-ti-cal-i-ty." She snapped off her 'puter with a loud, almost mutinous *click*. "Face fact, shipmaster! This world may be stuffed to the poles with rare minerals and the like, but—it—is—a—resource—waster. It's going to cost ten times its value to find, refine, and lift off one gram of anything useful."

"Your world is fairly hostile," said Mandalay, *very* softly. Life on Diamond's world was a continuous battle for bare survival. Yet despite that hard living she had never stopped resenting being drafted off it, Accord or no Accord.

"Shields tight, it is," Diamond bit out. "That's why I'm the tough-worlds expert . . . " Her voice sneered, as she flicked a glance around the despised chem-learners. "And as the expert I say, officially if you want, that this world is a *waste*." She folded her arms across her chest, body language screaming: *There it is, scouts. Accept it or prove yourselves the sludge-brains I* know *you are*.

Pyotr worried his lip. On his homeworld, as on Diamond's, waste was the ultimate sin.

"But suppose—" Lee and Jess put down their untasted cups of kaffen simultaneously; but it was Lee's turn to speak for the pair, so Jess kept silent. "Suppose the K'm'r'iiy or the Dlugs find a way around the problems. Then they'd have the advantage."

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Transparent lids snapped down covering Diamond's eyes; her nares and ears closed tightly. It was a gene-manipulated response to her home world's sudden disasters; a reflexive defense. "Are you saying that any of *them* are smarter than *humans?*"

Lee and Jess didn't have to look at each other. They were not telepathic, but they were physically identical and had been brought up together. They could read each other's body language as effectively as if they were sharing thoughts.

"Oh, no," Jess said. "But the resources here—this one tries, and that one. Over a long enough time, accident alone might show one of them an answer."

"They're right." Pyotr, youngest of the crew, the gold braid on his shoulders still showing storage creases, had the courage to butt in again. "Don't you see, *klejnot* Diamond, we can't afford to lose this world, waste or no waste. We've got to keep on trying."

"Waste," Diamond muttered, but this time low enough that Mandalay could ignore it . . . on the official level. But a glare out of slate-gray eyes promised trouble for the Scirroco-worlder, eventually.

Diamond sniffed. Trouble was something she knew how to handle.

"You're arguing regs, and waste, and minimum or maximum," Pyotr wailed, forgetting in his distress that juniors should give data when asked and otherwise be silent. "We should be tossing sops out the porthole and worrying about how long it's going to take to find the answer that has to be there."

Diamond gave him a cynical, sour smile. "The Universe doesn't supply answers just because you want it to, softskin."

"It doesn't hand them out gratis to people who don't bother to go looking for them because they think they don't exist, either," he snarled, forgetting his junior status again.

"Accordiates." Brown spoke, his voice a mild, hesitant tenor, as characterless as a computer-generated synthivoice. Nonetheless, everyone else listened intently. To Mandalay, he went on speaking quietly: "I generated a game theory summation on this world, using all current data in the banks. Lady Diamond is correct. This world's a dead loss, and the longer we stay here, the worse the loss is."

"Microchip-mind," Diamond muttered ungratefully.

Mandalay nodded, accepting Brown's conclusion. Nonetheless: "My crews don't quit," she repeated firmly.

"But you're using *her* data," Pyotr blurted.

Brown, like many ship-dwellers, had been totally permanently depilated. Thus he had no eyebrows to raise, even had he been the eyebrows-raising type. "Give me more data," he said equitably, "and I'll recompute."

"I haven't any new data," Pyotr muttered sullenly. "But I'm on the verge of a breakthrough, I know I am."

Diamond mumbled something that was, fortunately, audible only to Jess, sitting next to her. Jess smothered a snicker, and a quick flow of expressions passed it on to Lee, who also hid a smile behind a hand.

"Then, junior," Mandalay sounded her years suddenly, "I suggest you get

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to work." A glance at the chrom on the wall. "Break's over."

"Yes, ma'am!" He soared to his feet and was out the door before the syllables hissed by Diamond as he left percolated through his ears to his brain.

"Tongue-soldier!"

Pyotr sat on a groove of convenient height in what had become his favorite flesh-mountain, and brooded, legs splayed, elbows on knees, chin resting on clenched fists. Could eyes have observed him through the almost opaque atmosphere, he would have resembled a famous antique statue called the Thinker, with the addition of a thin envir-suit, complete with faceplate, and the almost imperceptible shimmer that marked the field that helped protect him from his outside environment.

"I scored high on intuit," he announced, not for the first time, although the thick atmosphere swallowed the words. "I *know* there's something here." Petulantly, he shifted position, one heel grazing the plush firmness he was sitting on, causing a series of tremors to radiate out from the contact.

"Argh," he told nobody in particular, since even somebody standing a few centimeters away couldn't have heard, unless Pyotr had his comm turned on, and he had deliberately turned it off. "Double argh. That idiot woman. Thinks nobody but her can cope. Thinks nobody but her can *think*." He shifted in his seat, and the flesh around him obediently responded.

"Humph." He bent over, shoved at the edges of the groove, molded the pliant flesh into a longer, deep niche, and lay down. "I ask you, Gargantua, is that any way for an officer to behave?"

Gargantua, having no mouth, said nothing.

Pyotr settled himself against firm warmth, cradled in somehow friendly flesh. "I know there's an answer." He locked his fingers together beneath his neck and stared upward at nothing. Not that there was anything to see except the softly glowing slopes of the flesh-mountain. And even that glow was swallowed up by the soup sardonically designated "atmosphere." He blinked as a flock of lightflies swirled by, glittering in the dimness, and were sucked into the paler light of the living mountain.

"Gargantua," he said wistfully, "I wish you could talk. I'll bet you could see everything if only you had eyes. I'll bet—"

But Gargantua had no eyes, or ears, either. Gargantua was simply a huge mass of living protoplasm, tunneled with passages lined with cilia to seine out the small animalcules that floated in the thick atmosphere.

Pytor brooded.

Chains of batwings, swirls of boomerangs, and a host of larger and smaller flightlings zipped or drifted by, many of them falling into the numerous small maws of Gargantua.

Time passed.

A flutter of movement brushed the atmosphere against the young man hard enough that he could feel the change of pressure even through the protec-field.

"Hey."

He sat up, peered through the eternal gloom to see what had disturbed him.

"Hey!" he repeated on a happy note. A dance-flyer had arrived, and good

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luck he was in the right quadrant to see the approach-pattern. He sat up eagerly, adjusting his IRs to most efficiently pierce through the opaque atmosphere.

Dance-flyers were tinker-bells grown to human size, except there was no fairy, just the exquisite beauty of the wings. This one was exceptionally graceful, as it went through a slow series of airborne pirouettes and caracoles. Some of the lightflies remained in the area, coating the dancer's wings with an angelic aura.

Pyotr didn't even realize there was a smile on his face, as he watched the dancer swoop and glide, coming almost imperceptibly closer to the flesh-mountain with each movement.

The flesh-mountain was moving, too, magnitudes slower, but responsive to the movements of the dancer. Waves moving out from the mountain met waves coming in from the graceful mobile. Pyotr could feel them, feel the changes. He didn't look up, though he knew that above him, two pseudo-limbs were slowly emerging. As the wings came closer and closer—

The two pseudos met behind the dancer, and the whole was slowly drawn back into the main mass and engulfed.

Pyotr sighed. It seemed a sad reward for beauty, to become dinner. None of which—

He kicked the groove and it deepened, and he settled more comfortably.

None of which solved his problem.

A finger tapped his ear, and he turned and squinted. A (presumably) human figure was looming over him. The finger tapped his ear again, and he let out a startled curse, and flicked on his comm. "Hi," he said glumly.

Humanity settled next to him. "Aren't you worried," Brown's voice came through the comm, "that this extremely large mass of protoplasm, which needs vast quantities of energy to keep going, will try to engulf you the way it did the dancer?"

Pyotr shrugged. "If it did, I have the protec-suit, hours of canned air, and my comm."

"Ah, so? Ensigns who take unnecessary risks seldom survive to be shavetails."

"I'm in no danger," Pyotr said, not knowing why he was so sure, just that he was.

"Data?" said Brown, characteristically asking for information.

"I don't know why," Pyotr admitted. "I just know."

"That is data," Brown said impassively. "Of a sort."

Pyotr muttered something in his native tongue that would not bear translating, adding a biting sentence in which the word Diamond was the only word in Accord.

Brown didn't bother to hide a smile, knowing the atmosphere would camouflage it. "I noticed the dancer as I came up," he said gently. "Did you can it?"

Pyotr cursed again, added in Accord, "No, I'm sorry, sir. It arrived without my noticing, and once I was aware I was so engrossed in what it was doing, I forgot to turn on the 'corder."

"Not to worry, son. I got most of it. But it would have been convenient to have a triangulation, to try for a 3-D analysis."

"I s'pose." A sigh. "They are so awfully fascinating, aren't they?"

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"Yes they are, son."

It was four days later that Pyotr spotted the tiny dance-flyer. He was sitting on his favorite perch on Gargantua, a screen on his lap, and delicate read-out wires draped all over him like ticker-tape from a parade. He was glaring at the screen and grumbling, when something brushed against his cheek.

He looked, up, startled, and saw the little figure, a tinker-bell-sized tinker-bell glowing in the dark, no bigger than his little finger.

"Hey!" He flicked his comm. "Hey, everybody, Pyotr here. I just spotted a baby dancer. Anybody else seen a little one?"

"How little?" came Brown's calm voice.

It was darting around centimeters from his eyes, leaping and pirouetting, soaring through the air like a Nureyev. "Five, six centimeters long, maybe," he said, gaze fixed on the swirling sprite. "Ultimate, but it's a little cutie."

"Must be an entirely new species," said one of the herm-twins. Probably Jess, Pyotr thought, whose specialty was the bio sciences. "Related to the bigger ones though. See if you can get it into a specimen bag, and—"

"I'm trying—" He put of his arms, hands curved, and the thing flew against one of his palms. "Ha! Got it!"

"Bring it in, I'll have a look."

"Ugh . . . I'm trying . . . " He was fumbling, using his fingertips to work a specimen bag off his belt, not easy when you have your hands together, and something small and quick is batting between them. "If I can just get my fingers into the mouth of—*ha!*" He snapped the fluttering bag shut, and spoke again. "I'm bringing it in now."

A little later he was saying anxiously, "You're not going to hurt him, are you?"

"Of course not," said Jess, peering into the impermeable specimen box that he had had ready in the air-lock, now enclosing a tiny swooping/bounding prisoner. "It'll last in there far longer than it will take me to run a complete scan. Then I'll pop it in one of my bigger live-boxes, run some harmless tests, and let it go."

"What about feeding him?"

"I've been propagating most of the animalcules that float in this soup called atmosphere. I'll keep plenty of them in its box. I don't know which it eats—"

"Suppose he eats something else."

"What? There's no macroscopic analog of plants on this world, the microscopic floaters are the equivalent. Animals come in assorted sizes, mostly big, bigger than him, but the 'plants,' the jobbos that make food out of natural materials, nothing but the air-borne micros. This world has a wacky food chain, but it seems to work. So as long as its air is full of the food it's used to, we can just hope it'll take advantage."

"Oh." Pyotr stared down at the tiny, frantically moving captive. "I'm glad. I'd hate for anything to happen to him."

"Nothing will. I'll scan it, and run my tests. What's the matter, ensign? It's only a specimen, after all."

"Well—" He had to have an acceptable reason. "He's the only one like that I've seen. I—I feel responsible, after all."

Jess muttered something that sounded

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suspiciously like, "You'll learn." Then, louder: "Don't worry. It'll be OK."

But the mini dancer wasn't. Two watch cycles later, he (or whatever) was dead.

Pyotr cuddled up against Gargantua's warmth and bulk, wishing that the envirsuits didn't make it impossible to chew a knuckle. In fact, it wasn't his knuckle he chewed when he was nervous or deep in thought, but the finger itself, the first joint. But with two layers of synthetic in the way, one a hard mouth-nose plate . . .

Brown, approaching from the ship, saw Pyotr slam a hand against the molded faceplate over his mouth and nose, and filed the odd bit of data away.

"I'm off watch," Pyotr greeted the older man as he sat down.

"Did I say anything?" the imperturbable programmer asked, in his normal gentle tones. A line of sparkle-bits snaked around one leg, giving it a pinkish halo.

"There's an answer," Pyotr said, almost accusingly. It was better than saying "It died!" though he would have used the same tone for either statement.

Brown had the sense to simply say, "If you believe so, perhaps there is." An angler-mouth swept after the sparkle-bits. He gave it a gentle kick. Not that it could bite through his suit, but that the mindless appetite would keep trying until knocked away.

Fiercely: "There *is*."

Soothingly, Brown said, "Yes."

"But how can we find it . . . " he sat up, stared out into life-freckled murk accusingly, "If everybody but me is just going through the motions?"

"Do you honestly think that?"

Sullenly, "No. I'm not accusing anybody of unprofessional conduct." A sigh. "But—"

"Why are you so sure?" Brown asked curiously.

"I don't know. I just am."

Brown seemed to be computing with that sureness as data for a second, then he shrugged. "No matter."

Pyotr slammed a fist against the yielding, warm flesh he was sitting on. "I know there's an answer," he muttered. "If only—if on—look!"

But Brown didn't have to look, the tiny dancer that had appeared out of the murk was fluttering around both their heads.

"Ah! This time we'll—" Brown was much more experienced, he had a specimen bag out and the mini-flyer netted before Pyotr had much more than taken a breath.

"No." Pyotr grabbed the bag with its fidgeting prisoner.

"But it's a spec—"

"I said, *no!*" He turned the bag inside out, released its dancing-on-air prisoner, who continued to swoop and cavort around the two suited heads.

"Why?" asked Brown, eternally curious and phlegmatic.

"I don't know." The tiny being circled his head like a living halo.

"Playing again, useless," came Diamond's sharp voice in their comms.

The two men turned their heads instinctively. She was standing perhaps ten paces away, watching, hands on hips, sardonic and sneering if body language was any indication.

She took a couple of steps toward them, and stopped. "Hey, that's an-

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other of the minis. Catch it, one of you two oafs, quickly."

"No!" Pyotr scrambled to his feet, the tiny winged being practically clinging to his head, as if it sensed menace in the slow approach of the third human.

"Yes! You're the one whining about not making an effort, maybe this little useless clot'll—" She reached out, and he instinctively shoved her away. In slow motion, she lost her balance and fell against Gargantua.

And disappeared.

"What!" Brown lunged toward where Diamond had been, his movements, as they all were in this atmosphere, slow and clumsy, like a running-through-molasses nightmare.

But Diamond wasn't there.

It took several seconds for the two men to realize what had happened. Gargantua had put out, not a pseudopod, but a wall of flesh. Diamond was under or behind that wall.

"Diamond," Brown said sharply, "can you hear me?"

"I'm . . . squooshed!" came the labored answer.

"Thank the Ultimate," Brown breathed. Then, loudly, switching on his officer's long-range comm: "Attention all hands. Brown speaking. Emergency. Our local pet flesh-mountain has just eaten Diamond. Suggestions, tools, procedures, *stat!*"

There was a babble in the headphones, then Mandalay sharply: "Quiet, everybody. Brown, report."

"What I said." He was kneeling by the spot they'd last seen Diamond. "It didn't use the pseudopod technique it uses on flyers. From all I can see, it just drew back a little and rolled over her."

"Is she . . . all right?"

Diamond answered for herself. "Yes. No. I'm . . . being . . . squooshed."

Pyotr hauled back and socked the wall of flesh. "Let her go!" he shouted. The flesh woggled where he hit it, but there was no sign of Diamond.

"Lee, Jess, Mandalay," Brown had had time to think things over, "we'll need a scanner to locate her, and tools to cut her back out with. She's not more than a few meters away from us, unless the thing is moving her within itself, only we can't see her."

"We're coming." Mandalay's voice was brisk. She had never lost a crew member on a survey, and she had no intention of starting now.

When the other three crew members arrived, riding the slow, larruping, all-terrain crawler, the two men were staring at Gargantua's blank side.

"We've triangulated," Brown said as the three scrambled off the crawler. "She's in there, I can't tell how deep."

"We'll scan," said Jess.

"No use cutting Diamond instead of alien," Lee corroborated. Sh/he noted that Pyotr was wearing another miniature flyer like a backward tiara, but said nothing. First things *first*.

It turned out to be utterly simple. At the first cut of the ultrasonic saw, the flesh separated like Moses waving his hand over the Red Sea, the neat surgical seam widening and widening, flesh drawing back, until there was a clean-cut valley, and Diamond lying in the center of it.

"Come on." Pyotr leaped in, jerked the woman to her feet, and retreated back out, all at the highest speed the viscous atmosphere allowed.

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"Ensign—" Mandalay started to protest, and then bit her lip. She would either have to cut out two, or have them both safe, before anyone else could interfere.

"I'm all right, I can walk," snapped Diamond, as Brown tried to pick her up. She was panting slightly.

"Back to the ship, where we can check you out," Mandalay snapped.

"In a minute." She picked up the largest cutter, stalked back to the flesh-mountain, and made another seam—or started to. Pyotr jerked the cutter away from her before she could make more than a comparative scratch, which flowed closed as soon as the cutter moved away.

"That pile of frackle tried to eat me," Diamond bit out. "I'm going to teach it a lesson!"

But Pyotr, still holding the cutter, stepped awkwardly away. "It thought you were a flyer," he said quickly. "You made motions, and then fell against it. It was just a reflex. It let you go when it realized it made a mistake."

"What!" Five voices squeaked or squealed.

"I think you're anthropomorphizing, son," Brown went on. "It may have acted reflexively, as you said, as though Diamond were a dance-flyer, but when she didn't absorb like a flyer would, it got rid of her."

Diamond had an odd sense of humor. "That's even worse," she choked out. "Inedible. Garbage. Spat out like a piece of synthi mixed into a concentrate bar."

In a second, they were all laughing, in relief.

* * *

A mini dance-flyer was fluttering on a pseudopod as Pyotr came up for another think-session on Gargantua's smooth warmth. Without thinking, he battled his way through the molasses-atmosphere/surface, and plucked the tiny victim away. "Go on, stupid," he muttered. "Fly!"

But it circled his hand instead. With a muttered curse, he walked away with it, not letting it go until he was a couple of hundred meters from Gargantua's nearest edge.

Like a lemming, it zoomed straight back to destruction.

Cursing, he followed, to again find it fluttering on a pseudopod. He reached out, then, frowning, started a 'corder. The flyer continued to flutter, then abruptly flew away.

But within seconds it was back, doing a dance less than a meter away. "Dumb whatsit," Pyotr muttered. "You'd think you wanted Gargantua to eat you. Not that having or not having your dinky mass'd make any difference to big G; but you'd be dead."

The flyer fluttered provocatively close.

"Like playing with danger, eh?"

The flyer batted up against his head.

"Dumb, dumb, du—" Pyotr stopped. His lips pursed like a specimen bag being drawn up. "No!" he said softly. "But suppose—"

Half an hour later, he was sitting in the scoutship, on an extruded seat not far from the air-lock, the environment suit in his hand, an expression of intense concentration on his face.

Jess came by, stared down. "Aren't you on watch, junior?"

"Tryin' an experiment," Pyotr mumbled, still with that concentration on his

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face. Beside him, a specimen bag rippled.

"You bring me another of those mini-dancers?" Jess reached out his/er hand.

"No." Pyotr shifted his body to shield the moving bag. "Part experimen'. Leave me 'lone."

"All right." The clone/twins were easy going. "Anything I can do to help?"

"Ye'. Go 'way."

Puzzled, the clone moved away.

It didn't work. Pyotr went to Gargantua to say good-bye. "Wacky idea," he said aloud, although he knew the flesh-mountain couldn't hear. "But I wish it had worked."

"What worked?" asked a voice, and Brown loomed up out of the murk, festooned with remotes.

"I'm just taking a break," Pyotr said hurriedly.

"Then I will, too." The older man sat comfortably down on Gargantua's ledge. "Never any trouble since Diamond?" he asked.

"No." Pyotr chewed his lip, under the molded mouthpiece.

"What wacky idea?" Brown repeated.

Pyotr sighed. But he knew that Brown was as stubborn as he was even tempered. He would keep asking until he learned what he wanted to. "Well, the dancers. Have you ever noticed, their dances are all different?"

"So?"

"So it dawned on me, especially after one of the little ones acted real funny around me, that maybe, maybe—" His voice trailed off.

"Maybe," Brown prompted, taking off three remotes, laying them aside on the flesh-ledge, and then arranging the others more comfortably about his lanky body.

"Maybe it was a—a sort of language. The dance was a form of communication. The flyers go from one mountain—"

Brown burst out laughing. Then, kindly: "Communication implies intelligence. The mountain don't have any structures to be intelligent with," he said gently.

"Any structure we can recognize," Pyotr said miserably. "But they're so big, maybe they have some scattered analog of a nervous system—"

"You're anthropomorphizing again, son," Brown said kindly. "You like them, for what reason I can't say, so you want them to be intelligent. It happens to us all."

"Anyway, I tried every way I could think of to get a message back. I thought hard, in case the flyers are telepaths, and I scraped skin cells onto the outside of my suit for if they pick up chemical signals. Then I gave the flyer a big portion of that synthesized food that Jess worked up, plus some tiny grains of minerals. I sang at him, using an outside-comm, and danced for him. Only," he said mournfully, "none of it worked."

Brown turned away, so there was no risk the young ensign could see the smile behind his transparent faceplate.

"I even got that big batch of synthesized food Jess made up when sh/he thought sh/he could catch one of the big flyers, and fed it to Gargantua."

"Did it eat it?" Brown asked.

"Slu-uuuup. But that was all. Now

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we'll be taking off in a couple of watches . . . ''

''Son, you can't win them all. This planet has resources, but it's too far away from Terra norm. We can't adapt to it, or use it. So it's a loss.''

''But if—''

''Run along, son. Break's over, and we've a lot to do before we up ship.''

''A lot to do—'' Pyotr stood there, frowning, as the other man headed back to the ship. Then his eyes narrowed. There was one thing he hadn't dared try—

There were emergency seals on the suit. If he tightened the wrist one, and then opened the suit at the fingers, he could touch Gargantua . . . The atmosphere wasn't corrosive, after all, just poisonous. If the seal held, he'd be OK. It was the one last thing left to try, an actual, flesh to flesh meeting—

He stood, hesitant, then slowly tightened the emergency seal at his left wrist—

Biting his lip, he opened the fingers.

Gargantua felt oddly plush, as if very fine hair covered what appeared to be smooth skin. He stroked for a minute, simply pleased at the smoothness. He'd had a pet as a child, a local animal with soft plumes all over its skin. For a second he was six again, cuddling up to his Jeepers.

He pushed against the firmness, and his fingers went in, the flesh sucking gently at the intruders.

He giggled softly. It tickled.

He pulled, and his fingers slid easily out. He pushed, and they went in again.

''Do your stuff, baby,'' he murmured. And coughed.

And coughed again. He felt dizzy, light-headed, his throat scratchy—

It was a second before he realized that the suit was leaking atmosphere. He was in trouble. Big trouble. He jerked his hand out, hastily sealed the fingers again. And sank to his knees, consciousness wavering, like a mirage in the summer.

''Helll-pp,'' he quavered, not knowing if anybody was near enough to hear his short ranged comm. ''He-eeeeeee . . .''

''Where's young Pyotr?'' Mandalay stopped her inventory abruptly to ask.

''Bringing in my specimen collectors,'' Jess answered. As the junior person, Pyotr ran errands for whichever of the crew that asked, along with his own duties.

Mandalay frowned. ''I told him to check the crawler and inboard it,'' she said, ''but that hold reads still empty. Did anyone else send him off for something?''

''No, and he should have been back ages ago with my collectors,'' Jess informed.

''I saw him over by that mountain of his.'' Brown surfaced from his data analysis. ''But that was—'' He glanced at the nearest chrom. ''—half a watch ago.''

''Anybody seen him since?'' Mandalay asked.

Four heads shook.

''Anybody sent him out for anything besides the specimen collectors?''

Four heads shook again.

Mandalay reached over to the comm panel and activated the longest range

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instrument. "Ensign Drijver, report," she snapped.

Silence.

"This is the captain speaking. Ensign, report!" This time, her voice echoed through the ship's speakers as well.

Silence. Mandalay checked a board, "No locators showing."

"Aboard, but asleep—" Jess offered timidly.

The ship was small. Mandalay snapped out crisp orders. It didn't take long to check every cabin and storage hold, space and niche. Back in the common room again, Mandalay looked her age, gray under the fading bronze.

"We'll start where he was last seen," she gave blunt orders, "and spread out and search. His locator may just have glitched." But the worried looks in five pairs of eyes proclaimed how unlikely they thought that was.

As it turned out, they didn't have far to look.

"Holy Smith protect us!" Diamond knelt at the edge of the wall of flesh.

"What is it, Lieutenant?" Four others crowded around her, and four torches shone on what Diamond was holding. It reflected back light blindingly, and they shifted, so that the torches were not directly on it.

A faceplate, with strips of envir-suit still attached.

There was a babble of sound in the comms, and then Mandalay's harsh authoritative voice cut through it. "Silence. Has anybody thrown out an envir-suit, or even just a faceplate, for any reason, since we landed?"

Nobody answered.

"Is there any way a suit could have gotten out here, other than being worn?"

Silence. Then Brown: "This is about where he was sitting, when I left him."

Diamond suddenly turned her torch outward. "Without a suit, he can't have gotten far—" The torch cut through murk, revealing nothing but ooze and the sides of Gargantua.

Lee was more practical. "I'll try the scanner—" Seconds slithered past. Then, disappointed, "Nothing. Nothing but muck and the usual flights of small flyers and a couple of dancers a bit away, and—"

Brown, looking over his/er shoulder, said, "You didn't use a full sweep."

"Yeah, you're right. He might have gotten around the mountain somehow. I'll just hop on the crawler and go around to the other side—"

"No," Brown said. "It seems impossible, but—what happened to the envir-suit?"

"Holy Smith." Diamond focused on the remnants still in her hand. "It looks . . . torn."

"But there are no large predators here," Jess protested.

Diamond snorted. "No large predators we've discovered."

"Turn—" For a second, nobody recognized the phlegmatic Brown in the strained tones. "Turn off your torches. All of them."

Nobody, even Mandalay, hesitated. Five torches went out.

There was the soft glow from the side of the mountain.

A soft, even glow.

Except in one spot, not three meters from where they were standing.

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A dark shadow like a blotch, almost at the base of the mountain.

About the size of a human body, if said body were embedded in the translucent, glowing flesh.

"Here." Brown sounded sick.

Jess said it. "That's what it looks like, after it's absorbed a flyer."

"He was so sure he was safe." Brown had regained his calm, but there was a thread of sadness. "He was so sure." A flight of greenglows swirled around his head, making his face look skeletal, like a ghost in a horror movie.

"Poor kid!" Mandalay reacted like a woman, but in a second she shook herself, like a dog tossing off water, and became again the brisk captain. "We'll recover the body. Lieutenants GAGBD," clones were identified by their strains, "get a couple of cutters from the crawler and get—him—out."

Easier said than done. Where the mountain had cleaved as though a modern Moses had passed his hand over it to produce Diamond, now even the heaviest cutters were useless.

"It's like cutting water." Lee laid the heavy cutter down, panting. "It just flows back in to fill the hole."

"Brown, didn't you adapt some chemflamers to use to get geo specimens, before we realized how deep the ooze extended and switched to borers?"

"Yes. You thinking heat would sear the edges, cauterize the surfaces, so to speak."

"Yes. We'll just make a big cut, work around him carefully—"

"Wait!" Diamond was staring at the dark patch. "Look."

The flesh is that area was glowing more and more brightly. The dark patch was becoming clearer and clearer, like a screen being tuned in to a transmission.

As though the thin wall of flesh was a window, and they could see in.

He was lying, suitless, curled up in a ball like a kitten or a tired child, the cans of air caught between his bent knees. One arm draped over his face, his pale, bare feet looking somehow absurdly young and vulnerable.

"Holy Ultimate," one of the clones let out on a breath.

"He looks so peaceful," the other finished.

"He does, doesn't he?" said Mandalay sadly.

"Curse you," Diamond smashed at the wall with her fist. "Curse you!"

As though the blow had been transmitted through the flesh, a pseudopod came out and smacked into Pyotr's back.

And he flinched away from the blow and curled up tighter.

All five of the crew outside jumped in different directions, then drew back, fascinated. It was Brown who spoke aloud what they were all thinking: "He said it wouldn't hurt him."

Mandalay was the practical one. "How long can his cans of air last?"

Brown pursed his lips. "After half a watch? Not long enough for one of us to take the crawler back to the ship and get him a fresh suit."

"Come up with an alternative," Mandalay bit out grimly, "or we'll all stand around here and watch him suffocate when his air runs out."

"Specimen bag." Jess made a gesture of snapping his/er fingers, although the atmosphere muffled all sound.

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"There's still some big ones packed on the back of the crawler."

"Right." Brown picked it up. "It'll act like a substitute envir-suit, at least long enough to get him back to the ship."

"You sure?" Mandalay asked doubtfully.

"Yes." Jess nodded. "They're impermeable. Meant to keep the specimens alive, even inside the ship, until you can transfer them to a specimen box. It'll keep him safe, as long as he's careful not to tear it, and he'll be inside the crawler most of the way."

"I've an extra air can." Brown unclipped it from his belt. "He'll need it."

"Me, too." Diamond added another can.

The specimen bags were tightly sealed. They had to be opened to whatever atmosphere they would hold. The humans piled two specimen bags—just to make sure—and four cans of air in a neat stack next to the side of the living wall of flesh.

"Now what?" Mandalay said. Life and safety were less than a meter away from the sleeping or unconscious man. But how to get them to him—

Diamond flicked on a cutter.

"No," said Brown firmly. He picked up one of the specimen bags, a roll about as long as his arm, and poked it firmly against the wall, just opposite Pyotr's shoulders.

Nothing happened.

He poked again, harder.

Nothing.

Jab, jab, jab, ja—

Slu-uuurp.

They could actually see the bright orange cylinder sliding into the flesh, traveling slowly toward the bubble or hole Pyotr was in. It was spat out against his legs.

"One down, five to go," Brown commented, and picked up the second roll.

This time it only took one poke. The second bag emerged neatly next to the first and lay against the long, curled up legs.

The cans were heavy enough that Brown slid them along the ground to nudge against the smooth wall. But they too were absorbed, and flowed—much more slowly than the specimen bags—through the pale jellyfishlike flesh.

"If he doesn't wake up—" Jess said worriedly.

"I go in and stuff him in the bags," said Brown.

"You will not. I'm not risking two of you—" Mandalay started, then stopped. The cans nudging against his legs had done what nothing else had. Pyotr was stirring.

His five crew mates watched, wide-eyed, as he stretched and rolled over, mouth opening in a wide yawn.

It was obvious the second he awoke that he realized something was wrong: he froze in the middle of a stretch and then, very, very slowly, turned his head around, looking.

He sat up, then turned on his hands and knees to stare out, eyes and mouth wide open.

Brown recovered first. He got as close to the wall as he could and pointed fiercely down at the supplies they had shoved in.

Pyotr's hand patted his mouth and he gasped. Then his eyes rolled around, and he stared back out pleadingly.

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Brown nodded, pointed again to the cans of air, the bags.

Pyotr shuddered. Even in the dim light, he was pale.

Brown made gestures. *Unroll the bags. Stuff one on the other. Put in all your cans of air. Seal.* He pointed behind himself, his hands made another gesture. *We have the crawler here.*

At first Pyotr looked puzzled. Brown made more gestures, pointing at his chrom. *No time! The bags will substitute for your suit. Unroll them and get in with the air and seal.*

Finally Pyotr understood. His arms made gestures. *Where's my suit. Get me a* suit!

Brown looked around, located the faceplate, brought it close to the wall. Pyotr flinched back. His hands shook a bag. *Must I?*

Brown nodded, tapped his chrom again. *Yes! Now!*

Pyotr's trembling lip was clearly visible. But he began unrolling the bags, no easy task when he lay curled up in a hole not much bigger than he was.

Endless minutes later, he was in the double, one-inside-the-other bag, with all the air bottles.

"Now how—" Mandalay muttered, but the ends of the bag were moving. Pyotr was kicking or thrusting forward, outward.

Obediently, the wall behind him was moving, pushing him along.

The specimen bag, Pyotr inside, emerged from the side of the mountain like a child sticking out a bright orange tongue, slowly and pertly.

From there it was . . . not easy . . . but doable. They carried the bag to the crawler, loaded it on, and headed back to the ship at top speed.

A watch later, fed, rested, and checked out by Mandalay, who doubled as medic, Pyotr was ready for a ship's conference. But he didn't have much to tell—

"I was choking, I realized that my suit was leaking—and I remember falling—"

"You didn't crawl in there on your own?" Mandalay asked, frowning.

Pyotr shook his head. "I may have thrashed about a little instinctively, after I fell—but I think not. I think I just fell."

"Why did you tear your suit off? Even if it was leaking, it would protect you somewhat." Jess wanted to know.

Pyotr only shook his head again. "I didn't take it off," he said, suppressing the memory of unsealing the one wrist.

They discussed it a while longer, until Pyotr almost casually dropped his little bombshell. "You realize what this means—we aren't leaving now."

"Why not? Just because you had an accident and survived by luck," Diamond snapped.

He gave her a sad and oddly mature smile. "How long was I unconscious, before you found me?"

"We can't know," Brown answered. "How long after I left you did you have—before you started choking."

"Only a few minutes."

"Half a watch, more," Brown said.

"Uh-huh. Then how did I survive, unconscious, for more than half a watch?"

"Your air. Your open can from the suit was in with you," Lee said.

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"So it was. I had an empty when I woke up. Plus an uncracked bottle. Don't you see what that means?"

"That we came just in time," Diamond said, bored.

"No. I only had about a half hour of air left in the can I was breathing. Enough to fill a hole that size? I don't know without running a calc. But surely not enough to last me half a watch. Unless somebody—or something—supplied me with more. Gargantua didn't just get me inside and safe and out of my leaking suit. She made sure I had what I needed to survive."

Dead silence.

"Captain?" Pyotr asked softly.

Four hundred and seventeen watches later, Pyotr fed Gargantua another huge mass of synthesized food; and she gave him back a small lump of what later proved to be 99.9999% silver.

The humans breathed collective sighs of relief; though perhaps it was a blessing they couldn't see too far into the future . . .

* * *

Rough translation from a dancer-message (spied on) from the flesh-mountain human-named Gargantua to the flesh-mountain human-named Rushmore, some thirty human years (one ten-thousandth of a flesh-mountain life-span) after First Contact:

. . . the wingless tinies (humans) have been trained (taught?) to synthesize the most delightful flavors, and I/we am now rewarding them with trace nutrients (germanium, platinum and other rare minerals). I/we continue to be pleased (vindicated?) by how remarkably quickly they respond(?). Except that they remain universally clumsy at dance-speech, probably because of their lack of wings. I(?) suggest (?), after a respectable(?) time for debate on the matter, a committee (representation? volunteers?) be formed(?) to devise a way to breed wings or some acceptable alternative(?) on them. In re more important matters—

The humans who translated the message laughed.

But a mere three thousand years later . . . ■

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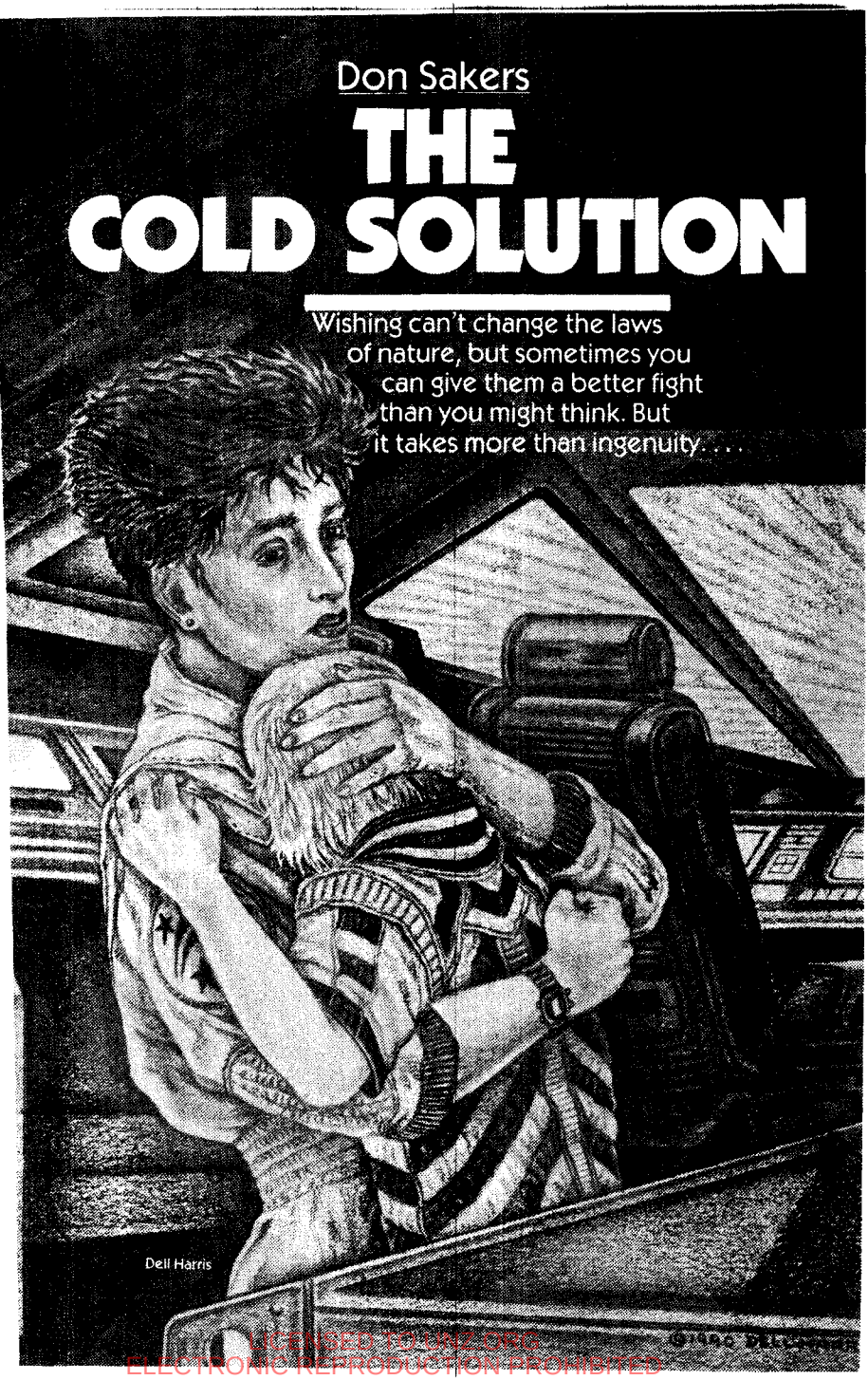
Don Sakers

THE COLD SOLUTION

Wishing can't change the laws of nature, but sometimes you can give them a better fight than you might think. But it takes more than ingenuity. . . .



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She wasn't alone.

There was a stowaway aboard.

She'd read a story like this once, a story so old that the original had been on paper, not wafer. All Space Force Cadets read the story—it had even been viddied a few times, but nothing could compare with the starkness of words on a bare screen. In her Academy days, they'd all stayed up late marveling at the prescience of that pre-spaceflight author, who had described it all so well.

Now it wasn't a story.

"All right, you can come out," she said in the direction of the supply locker. "Your free ride is over." At the same time she fingered her laser knife, holding it ready in case the stowaway gave her trouble. She'd never faced one before, not in all her eleven years in the Force . . . but you heard stories from other pilots. Some stowaways fought, some threatened, some pleaded, some even tried to bribe you—but in the end, according to the inexorable laws of physics, all of them died.

It was sad, she supposed, in some abstract way. But Space didn't care about simple human concerns like life and death. Space was cold, and all it knew was the bottom line of its cold equations.

Self-defense, she thought. The minute her unwanted guest decided to stow away, he had sealed his fate. It was him or her. And she wasn't going to let it be her.

"Show yourself right now," she said through clenched teeth. "Or I swear, I'll shoot."

The locker door opened, and a timid voice said, "Don't shoot. I'm coming out." Then the stowaway stepped into view.

It was a boy.

The pilot closed her eyes, and for an instant she prayed, prayed to whatever gods lived out here on the edges of the explored galaxy. *When I open my eyes,* she thought, *it won't be a boy standing there, it'll be a thirty-year-old fugitive.* That was how it was *supposed* to happen.

But out here there were no gods but space itself, and when she looked she saw only sandy hair, and freckles, and a lopsided grin flanked by a single dimple. He couldn't have been more than ten.

And no matter what she did, no matter that she wanted desperately to be anywhere in the universe but here—the boy was already dead. Despite his cheery smile and his bright eyes and his fidgeting hands, he was dead, dead as space itself.

She lowered the laser knife and closed her jaw. "What are you doing here?"

"I'm a stowaway. I want to go to Lethe with you. My uncle Mark works there." The boy said it so simply, as if it were a self-evident geometrical axiom. "I know I wasn't supposed to, but I haven't seen him for a long time."

"How old are you?"

"Nine."

"Do your parents—" She stopped herself, knowing only too late what his answer must be.

The boy shook his head. "They don't know I'm here." He glanced at his watch. "They're probably still asleep, back on the ship." Cocking his head at

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Diane, he asked, "How come you launched in the middle of the night?"

He knew nothing, she realized, of the inexorable mathematics of celestial mechanics—the mathematics which had already killed him. "Th—the launch window was just twenty minutes wide," she said, not caring whether her words meant anything to him. "There's only one optimal trajectory to Lethe tangent to the ship's flight path." And now, she thought, the ship was back in hyperspace . . . beyond contact until it reached its destination. The lad's parents wouldn't hear the news of their son's fate until two weeks from now, when the ship burst out of translight in the Gondwana system. Two weeks too late . . .

"How did you know I was going to Lethe? What made you think of stowing away?"

The boy thrust out his chest and beamed. "Technician Godwin told me. We're good friends."

"Do you know *why* I'm headed there?"

Another nod. "Medicine. For the plague. We were worried when we heard about it on the news. With Uncle Matt there, and everything." Incredibly, he was still smiling. "But now everything's going to be all right, isn't it?"

"Wait. Don't move." Diane closed her eyes, leaned her head back on the command chair, and concentrated. From the million tiny pinpricks of the nerve inducers, she felt the computer's cool, quiet presence in the intricate neural lattices that filled the whole structure of the boat. Without a pilot's living brain in the circuit, it was no more intelligent than a wrist chronometer. But when joined to the implants in Diane's brain tissue, the computer could easily handle the millions of picosecond calculations of close approach, effortlessly direct the boat's thrusters to ensure a safe entry and touchdown.

Pilot and computer, each incomplete without the other—and together, more powerful than both.

But not powerful enough.

In answer to her unasked question, Diane felt the numbers within her mind. The boat was 31.62 kilograms overmassed, and therefore using an extra six grams of fuel per second, each second of deceleration. It might as well have been sixty grams a second, or six thousand . . . the boat would arrive at Lethe some seventy kilograms of fuel short. And then it would burn up, a splendid meteor trail in Lethe's nighttime sky.

Damned if it *will*, Diane thought.

The kid twitched. "Look, I know I wasn't supposed to stow away. I'm sorry, and I'll take whatever punishment I've got coming."

"Do you know what's going to happen to you?"

"I'll have to stay on Lethe until the next ship comes. And that'll be months. I know. I'll stay with Uncle Mark. Do you know him? Mark Sadako, he works in the Colony Survey office."

Diane shrugged. "I don't think so. This is only my third trip to Lethe." And probably my last, she finished, to herself. The regulations say this kid has to die—but I'm still going to get buried for it.

"He's a nice man. Look, if there's any kind of fine or something, Uncle Mark will take care of it. Or my Dad. He has *lots* of money."

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There's not enough money in the Universe, kid, to change the laws of physics.

Why couldn't it have been a fugitive, or transportee, or some terrorist on a mission from God? Gods of all heaven, why did it have to be an innocent little boy?

She turned to the control board, at the same time framing a command in her mind. The computer obediently opened a hyperwave comm channel. "Lethe Port here." The voice filled the tiny cabin. "Identification, please."

"DelMinna, Boat 378H7. Get me the base commander."

"Why—"

"This is an emergency. I want your commander on the line, and I want him *now*."

"Hold on." Diane had to give Lethe Port credit; in less than a minute another voice, this one deeper and more controlled, said, "Commander Barker here. What's your situation?"

Diane took a breath. "Commander, I'm about seven hours out from Lethe. . . . "

"Is the medicine all right?"

"Yes. It's not that," She took a breath. "The problem is, Commander, I've discovered a stowaway."

"Is that all?" A patronizing tone crept into the commander's voice. "Let me look at your telemetry . . . hmm, pretty tight on that fuel reserve. You're thirty–two kilos over. You'd better jettison within the hour, or you'll be short for landing."

"That's the thing, Commander. This isn't an ordinary stowaway."

"I don't care *who* it is, Pilot, that medicine has *got* to get here safely. I want you to—"

"Commander, he's a little boy."

"What?!"

Carefully, slowly, Diane replied, "Commander, my stowaway is a nine-year-old boy. He didn't know what he was doing." She bit the words off savagely. "One of your ColSurv people is the boy's uncle. The kid just wanted to see him."

All trace of patronizing was gone from the commander's voice. "Stand by, Pilot. We'll get our people to work on it."

"Commander . . . the kid is right here, watching me. What should I tell him?"

There was a long pause, then in a tone laced with infinite regret, the commander replied, "Tell him the truth."

"What's your name, kid?"

"Tony." The boy hung his head like a puppy caught making a mess in the house.

Diane's brain had gone on vacation, leaving her vocal chords to figure out what to say all on their own. What *was* there to say? No perfect words had ever been invented for this situation. "Tony, you have to understand something." Why was it important that he understand? Why couldn't she just slug the kid, knock him unconscious, throw him in the airlock and be done with it?

Because she had to live with herself afterwards.

"Tony, the payload of an emergency boat like this has to be carefully figured. Every gram counts. That's why emergency boat pilots are usually women. But when they fueled the boat, they

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didn't figure on your extra mass. Do you understand that?"

Tony nodded, but kept his eyes down. "I guess we're using more fuel than you planned. I'm sorry about that."

Sorry isn't enough. "That's the thing, Tony. The people on Lethe have their big computers working on this, but right now . . . well, it looks like we're going to run out of fuel before we get there. We won't have enough to land safely."

Tony raised his head, and his eyes were dry. Diane wondered how long they'd stay that way. "Why didn't they give you more fuel?"

"Everything is calculated. The ship doesn't have much fuel to spare—and every extra gram of fuel meant at least one less gram of medicine for Lethe." She wanted to turn away from his accusing stare, wanted to shout, "It's not my fault!" Instead, she forced herself to meet his eyes.

"S-so I guess you have to jettison something. That's what the commander said, isn't it? You'll have to throw something overboard, to make up for my mass. Geez, I'm sorry."

"Tony, we—" The chime of the hyperwave interrupted her.

"Boat 378H7, this is Commander Barker. Look, DelMinna, our computers have looked at the problem, and they have some recommendations for you. Number one: you'll approach Lethe on an orbit that's a bit more shallow, so you can pick up some extra delta-vee by skimming off the atmosphere. Number two: Your landing site will be changed to a splashdown in the inland sea; one of our helicopters will pick up you and the medicine."

"And what does that get me?"

"You're still twenty-five kilos overmass. And your approach will hit five gees. But you won't have to do a jettison until seventy-three minutes before splashdown."

An hour and a quarter short.

Might as well be a year.

Hey kid, Diane thought, can you hold your breath for seventy-three minutes? Can you flap like a bird and make atmosphere entry safely?

She swallowed, "Is that all you can do for me?"

"That's all the computers can come up with. What did you have in mind?"

"I don't know." Refueling? Don't be stupid, Diane. You're falling toward Lethe at better than two hundred kilometers a second. What are you going to do when a fuel rocket goes past—reach out and grab it with a butterfly net? "Jettison at seventy-three minutes before touchdown, eh?"

"That's the best we can do for you, Pilot."

"Thanks. Out." Bitterly, she commanded the computer to cut the link. As it did, the machine signaled seven hours until touchdown.

Tony had five and three-quarters hours to live.

Diane opened her mouth, then closed it. The words wouldn't come—she doubted that there *were* words.

Tony looked around the small cabin. A single glance sufficed. Control chair and board, airlock, cargo cupboard with its load of medicine, broom-closet supply locker . . . that was all. "When it comes time, what are we going to throw out?"

Diane couldn't make herself be cruel enough to do the kind thing, and tell the

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kid right away. She stalled. "There isn't much to get rid of." Please, gods, let him at least figure it out for himself, so she could be spared pronouncing the sentence of death.

"It doesn't look like there's *anything*. I guess you'll toss out food and water—"

"There isn't any food aboard, Tony. Only a couple of liters of water."

"And you can't throw out the medicine." He looked again, more carefully, and his eyes grew wider. "The locker doors are welded on, so is that couch you're sitting in."

"The control couch is part of the navigation system. Even if I *could* rip it out, the ship can't land without it."

"Your pressure suit?"

"There isn't one aboard." She waved at her jumpsuit. "All I have is what you see."

"Then what are you going to jettison?"

She couldn't delay the awful moment any longer. "Tony . . . the regulations say that any stowaway must be jettisoned." She noticed that her knuckles were white on the grip of her knife, and forced her hand to relax.

For a moment, Tony's expression was unchanged—then all too quickly, the lad of nine grew up, and cold terror entered his eyes. "I–if I leave the ship, I'll *die*."

"Tony, there's no other way."

"You can't do that." Tony backed up a step, found himself pressed against the airlock's inner door, and moved sideways to the supply locker. "I haven't done anything to die for."

"I know. I'm sorry." Her heart thudded, and each breath was agony. "I–I wish I could take your place. But don't you see, you couldn't pilot the ship. The computer needs a trained pilot in the couch. I'd just be killing both of us—and all the people on Lethe who need the serum."

"There's got to be *something* we can do."

She shook her head. "You heard Lethe Port. Even using our full fuel reserve, we're twenty-five kilos overmass."

"I weigh thirty-one." The boy plucked at his shirt, garish red and orange synthetic. "If we get rid of our clothes, and our shoes, and the couple of liters of water . . . and if we could cut these doors loose. . . ."

Diane shook her head. "Five kilos, maybe. Not enough."

"Can't we go into orbit, and wait for another ship to come get us?"

"Tony, Lethe's a new colony. They don't *have* any ships. That's why we have to send an emergency boat."

"Isn't there *anything* that anybody can do for me?"

She closed her eyes. "No. Nothing."

"Do you want me to die?"

The question was so innocent, asked in such a gentle tone, that it finally broke Diane's reserve. Her eyes filled as she reached out her arms to the helpless little boy. "Of course not. I don't *want* it to happen." He fell into her arms and she squeezed him tightly. His sobs shook both their bodies. "Nobody wants it. But space doesn't have any feeling, Tony. Physics doesn't care what we *want*."

Tony was silent, then, quaking with quiet sobs, Diane held on, and sobbed along with him.

* * *

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The boy asked to use the control keyboard to write a letter to his parents. Diane gave him the control couch and busied herself counting the vials of serum in the cargo compartment. When that palled, she leaned against the wall and stared at the airlock, thinking.

Clothes and water, five kilos. They could each shield some vials with their bodies, throwing out some packing material—another kilo or two. If they both emptied their bladders. . . .

No good. She sniffed, noticing that the air was already a little stale. The recycler was calibrated for one occupant only.

Air! Trying not to show any eagerness—for to give Tony any false hope at this stage would be viciously cruel—she calculated mentally. The airlock had a volume of about three cubic meters. If she disabled the pumps and dumped an airlock-full at a time into space, reduced the pressure by a quarter, maybe a third—

In spite of herself, she sighed. At most, dumping the air would only get her a kilo or two. Still nowhere near enough.

Diane put her head back against the wall and closed her eyes. There was nothing to do, nothing at all. Tony's fate was sealed, sealed by the cold equations of nature, and nothing human had any power to stop it. Maybe, she thought, we don't belong out here at all. Maybe we should have stayed on Earth and minded our own business. Then there wouldn't be any colonies, no ships, no emergency boats.

And no little boys would have to die.

But little boys died all the time, even on Earth, died in accidents, died of horrible diseases that wasted them away to nothing, died of hunger and neglect, were murdered . . . little boys had always died, as long as there *were* little boys, and nothing was ever going to change that fact. Wishing, no matter how desperately, would not change the Universe's cold equations one bit.

The gentle buzz of the computer's alert signal pulled Diane to full consciousness. Had she slept? Apparently, for when she glanced at the chronometer she saw that they were two hours away from landing.

Tony was awake, too, his eyes intent upon her as he gave up the command couch and allowed her to settle her head within the computer's contacts. She didn't know if he, too, had slept . . . . and she realized it was not her business how he'd spent his last hours.

"Is it time?"

"Almost," Diane said. "Just over forty-five minutes left."

"You're going to have a hard landing, aren't you? Because of me."

"It's nothing worse than what I went through at the Academy," she lied.

"But the medicine will be all right, won't it?" He glanced back at the cargo compartments. "It's important to me that the medicine gets there OK. I'd hate . . . I'd hate to die for nothing."

Diane nodded. "I'll make sure it gets there safely."

Tony lowered his eyes. "I–If I go now, you'll have a little extra fuel. Just in case something happens."

She didn't know how to answer him.

"I . . . I want to say thank you. You've been good to me. I know that there's no other way, and I know you'd do something to help me if you could."

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He raised his chin and stepped toward the airlock. "I'd like to do it now, please."

"Tony." He kept his back to her, didn't see her outstretched hand. He faced the airlock, and the cold bitterness of space beyond. With his head high and his shoulders square.

And the gods of space, she thought, would have one more sacrificial victim, one more life to prove that their word was law. They weren't cruel or vindictive, they weren't even gods at all—just impassionate Nature, her will expressed in the frozen lattice of her cold equations.

Damn it, Diane thought, It isn't mankind's way to give up and yield to responsibilities. There was something within the human animal, something which wanted to fight back. She'd known that ever since she'd read that oh-so-prophetic story, had known it when her heart protested, *there has to be a way.*

"Will you open the door, please?"

"Tony," she pleaded, "I want you to know that I wish I could do something to save you. I don't like this any more than you do." Except you won't have to live with the guilt for the rest of your life. "I'd give anything to stop this from happening. I'd give . . . anything."

In that moment, her mind was made up, and she knew what she must do. Just as good that he had his back to her, for if she saw his eyes, she would never be able to act.

Quickly, silently, she raised her laser knife, dialed the beam to maximum, and thumbed the button home. A ruby-red beam lanced forth, filling the cabin with an eerie, bloody light.

"Pilot DelMinna? Pilot, can you hear me?"

Diane opened her eyes on a hospital room. She was in bed, wired to a dozen instruments, and a bearded face was looking down at her. She'd seen him before . . . yes, the Lethe Base commander. "Are you awake?"

"Yes," she croaked. "But I wish I wasn't."

"I can understand. You've been under sedation . . . and hypnotherapy . . . for six days." He touched her shoulder. "The Space Force top brass want to speak to you on the hyperwave. There are commendations to be given and medals to be awarded, and I'm sure they want to put you through the worst debriefing in history. I told them they can't have you until you feel up to it."

"Thank you." Something rumbled in her gut, and she turned her head away. When the feeling passed, she looked back at the commander. "The serum . . . ?"

"The serum survived your landing beautifully, and it's been distributed throughout the colony. MedCorps says the plague is under control. You're a hero, DelMinna. In more ways than one."

"Yeah." She sighed. "What about Tony?"

"The boy is safe and sound, not three doors down from here." He smiled. "You can see him, if you wish."

"I don't know. He might not want to see me."

"He's asked for you."

Diane shivered. "How will he be?"

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"I should let his doctor answer that—but I can give you an outline. They say that he's young enough for regeneration treatments to take. In another year or two, he'll grow back that arm, and both legs. In two years, they swear he'll never even know they were gone."

Before her mind's eye flashed the memory of that horrible instant when the laser beam connected, the awful smell and Tony's scream.

"You did the right thing, Pilot." The commander gripped her shoulder firmly. "Your laser cauterized the wound instantly. The computer records that you started approach to Lethe a good two kilos under maximum mass. Good thinking."

She was afraid to lift her sheet, afraid to look—but she had to know. "And me . . . ?"

The commander's face clouded. "Regeneration isn't an exact science. After a certain age, the cells lose their ability to . . . that is, the medical team tried everything they could think of. . . . "

She covered his hand with her own. "Don't worry," she said, nodding. "I'm not sorry for what I did. I can live with it." She forced a smile. "After all, it's not like I live and work under gravity." She shrugged. "What does a pilot need legs for?" If she said it enough times, she thought, she'd even start to believe it.

"In your case, they came in handy," he grunted. Then, under the pretense of covering a nervous cough, he took his hand away from hers. "DelMinna, you're going to be the talk of the Space Force for this little trick. You're the only pilot who's ever figured out how to beat the Cold Equations scenario. What made you think of it?"

"Something I almost said to Tony, at the last minute." In imagination, she was back in the cabin, and she knew that a part of her would always be there. "I told him that I'd give anything to avoid throwing him out the airlock." She gave a chuckle that wasn't entirely forced. "I almost said: *I'd give my right arm to stop this from happening.*" She shrugged. "After that, it was simple."

Simple. So why would it haunt her for the rest of her life?

Because Nature doesn't suffer her defeats gladly, she thought. *And there's always a price to be paid.*

"Would you like to see the lad now?" The commander stepped back. "Orderlies are ready to help you."

Diane closed her eyes, and looked again on her moment of truth. *I'll pay the price*, she thought, *And gladly. That's part of being human.*

She opened her eyes and nodded. "I'd like that very much." ■

The old story Diane remembers is, as many readers will already have recognized, "The Cold Equations," by Tom Godwin (Astounding, *August 1954*).

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The Alternate View

RADAR AND LASERS, CHOW AND ROCK

G. Harry Stine

For the past two years, I've been deeply involved in some fascinating work. I hope to tell you more about this in the months and years to come by means of longer science-fact articles in this magazine as well as books, both fiction and non-fiction.

I've been working as a consultant on the National AeroSpace Plane (NASP) X-30 program. My task has been to figure out how to transfer the very high technology being developed in the NASP program by government labs and aerospace companies to "low tech" non-aerospace domestic industries in the fastest and most efficient manner.

This isn't an easy job, as I found out. It involves more than announcing that you have a better mousetrap and expecting the world to beat a path to your door. In today's industrial market economy environment, that's just about as effective and workable as Henry Ford figuring that he can toss Model Ts (or Escorts) on the market and sell them without advertising just because he can make them cheap and black. What worked for Ford in 1908 won't work for Ford Motor Company today. Automobiles and everything else must be *marketed* these days. As I discovered, technology must also be marketed and sold as if it were just another product or service.

In the United States, over the last fifty years, we haven't done very well at technology transfer from government labs and contractors to mundane domestic industry. Some people claim we have, but I believe they may be mistaken or poorly informed. A great deal of government-sponsored research has been done, but we haven't managed to transfer enough of this technology into our everyday world. Where we did manage to do so successfully, the results have rarely been spectacular. More often, they have been disappointing. In most cases, however, government-funded aerospace technology has appeared too complex, expensive, specialized, and "alien" for industrial engineers to even consider. As a result, these engineers and their companies are missing a big opportunity to remain competitive in a world economy that's growing more high-tech every day. But it isn't totally their fault. The government-funded high technology hasn't been packaged and marketed properly to them in spite of such publications as *NASA Tech Briefs*.

Part of my work involved studying a representative sample of historic tech spinoffs. Where did they come from? Why were they successful? How can we use this information to help accelerate NASP X-30 technology into non-aerospace industrial applications without long time lags and false starts? The results of this study are so fascinating that I thought you might enjoy them, too.

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They are also likely to blow away some of your most cherished beliefs.

Take Teflon™ for example. It isn't a spin-off from the space program. Or even the ballistic missile programs. Your non-stick frying pan is the result of the work of a contractor for the US Army Engineers Manhattan District (usually mislabeled the "Manhattan Project") which was the cover name for the development of the atomic bomb. Teflon™ was developed by E.I. DuPont de Nemours & Company in response to a desperate need for a material that wouldn't react with uranium hexafluoride in the uranium enrichment process. Teflon™ is an "introverted molecule"; it doesn't want to get together with any other molecule except itself. It's perfect for lining pipes and making gaskets and valves and other gadgets to handle uranium hexafluoride. It's also expensive. Teflon's™ price would undoubtedly come down a great deal if more tech spin-offs had been discovered for it. The annual market for Teflon™ is so minuscule that it isn't broken out by itself in the specialty plastics portion of the US Department of Commerce annual document, *US Industrial Outlook*.

Among the other high-tech spin-offs looked at were such things as business jets, radar, lasers, and solid-state digital computers. Not a one of them came out of the space program although all were used there. All of them were developed by private industry, sometimes with some government funding, and all of them ended up producing gadgets and devices and effects that were largely unsuspected by their inventors because private industry was free to determine the best applications in the best markets. It turns out that the obvious spin-offs were not the most lucrative or the most far-reaching.

It began to appear that government-developed high-tech had few if any domestic markets. Or was it because government-oriented people such as civil servants and aerospace engineers, awed by their beloved technology, were looking at the obvious applications and not aware of the grungy little everyday problems of some production engineer trying to punch out millions of commonplace products with a very sophisticated production process?

I found lots of examples of this sort of thing.

One example is the corporate business jet. It did indeed come from a United States Air Force requirement for a small, high-speed utility and VIP transport airplane. The North American T-39 Sabreliner was one of the results of this requirement. However, neither the USAF or North American believed any other market or application existed. It took a company named Remmert-Werner in Saint Louis to realize that CEOs were VIPs, too. They arranged to buy stripped T-39s from North American, which were ferried to Saint Louis where Remmert-Werner installed plush executive interiors and gave them pretty paint jobs. People like Bill Lear and Cessna saw the results (and the market) and gave birth to the Learjet and the Citation. What no one foresaw (or could have foreseen) were the consequences of airline deregulation and the major airlines' discovery of the "hub and spoke" system of operation. The military utility transport forms the foundation for today's feederliner baby jets

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such as the Canadair Challenger. Furthermore, some business people need to get to more than the 646 airports served by commercial air carriers; bizjets can get into most of the 12,950 other airports. But the consequences of the business jet went far beyond providing fast travel almost anywhere for corporate managers; it created luxurious airport facilities for everyday general aviation pilots. Twenty years ago, the average municipal airport probably had some sort of commercial terminal for airline operations plus a mom-and-pop "fixed base operator" (FBO) for general aviation activities. Most of these FBOs were just short of wretched, as the wives of most general aviation pilots would eagerly attest. The arrival of bizjets meant that these mom-and-pop FBOs had to shape up for a new level of clientele or go toes-up. Some adapted, some died. Today, general aviation pilots and their wives can and do use the same luxurious airport facilities as the people who travel in the "corporate iron." And, except for very small towns where bizjets rarely land, the airport environment has changed drastically as a result. The bizjet created a whole new support infrastructure of businesses that Remmert-Werner probably never envisioned.

The biggest, most lucrative, and most world-shaking tech spin-off of the World War II technology of radar took a long time coming and was the result of private enterprise seeing an opportunity and making the best of it. No one in government had really thought broadly about what could be done with modest levels of radio frequency emissions in the 1,000 megahertz region. They didn't look at or weren't aware of the possibilities of other applications. Radar was obviously good for tracking airplanes and ships. It could even be used to track storms and precipitation. Or to guide missiles. But every radar operator in the late 1940s knew that you *never* stepped in front of the antenna of an operating high-power radar set. One of the favorite tricks in radar safety education was to toss a ball of steel wool up into the beam in front of the dish. The steel wool would vaporize almost instantly. Then some bright person who was obviously also a generalist figured out that the radio frequency energy which vaporized the steel wool could also heat water if the frequency matched that of the molecular bond of a water molecule. Today, several thousand real radar sets exist in the world, doing what radar has been doing for fifty years. But more than 70% of the homes in the United States, more homes than have a clothes washer, have a microwave oven in the kitchen. The market for these radar-originated cooking tools was in the millions of units. But the consequences are even more astounding. The microwave oven created a major shake-up in the food industry and the packaging industry. Foods had to be available and packaged so that they were "microwaveable." This, in turn, had a major effect upon the labor market because more women who were formerly homemakers could get a job outside the home and not have to spend as much time preparing meals. (Or was it the other way around?) Shortly before this was written, the Department of Defense announced that more than 2.5 million microwaveable meals would be sent to the forces de-

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ployed in Operation Desert Shield, which means that radar created a major change in the logistics of military forces . . . and a blessed relief from Spam™ for the troops on the line.

Then there is the laser. A higher high-tech gadget is hard to imagine. Invented in the 1960s, it was for many years an "invention looking for a job." It found one. A *big* one! And not at all where anyone expected. The market was huge. It caused a major change in many industries. Sure, a laser can burn holes through razor blades. High-energy lasers can destroy aircraft or incoming ballistic missiles. Lasers are used to cut cloth in the garment district of New York City. Laser cutting tools can perform miracles of machining. Laser scalpels have revolutionized medical surgery. But those applications and their markets were puny compared to the Big One that has emerged in the 1980s. No one would have suspected in 1960 that the laser would cause the complete death of an industry thirty years later, all because lasers, high capacity communications, and digital processing go together like they were designed for one another. Edison's "only original invention" is now dead because no one in the United States is making vinyl long-playing disc recordings any longer! The Compact Disc, the CD, has swept the audio market and is already threatening to destroy the industry involved with magnetic recording media. CD-ROMs are penetrating the computer market even as you read this. Within a decade, erasable, reusable CDs will be the preferred means for storage of information—visual, audible, and textual—just as the technology of optoelectronics will make today's telecommunications systems as old-fashioned as the crank telephone set. It would have been impossible without the laser, and the laser was *not* a spin-off of any government space or defense program.

Is the computer a high-tech government spin-off? Not really! True, the government invested in early analog and digital computer technology back in the days of World War II and vacuum tubes. The research produced computers that were huge, power-hungry, unreliable, and with far less power than today's laptop. It was the private invention of the integrated circuit by Dr. Robert Norton Noyce and Jack Kilby that changed all that. Thanks to a Japanese company who wanted Intel to build a small desktop calculator, the first 4004 microprocessor was developed by Marcian E. "Ted" Hoff in 1969. Then entrepreneurs such as Steven Jobs seized an opportunity to build computers for hobbyists . . . and today's personal computers came into being. The modern solid-state microcomputer is not a spin-off from government R&D!

I learned a lot while making this study of historic technology transfer examples that everyone takes for granted—and usually incorrectly, at that. I hope you've learned something, too. We'll talk more about technology transfer and tech spin-offs in future columns and articles because it's fascinating and, if you understand them, you can make a bundle. Which will give you all sorts of power to change the world in ways you probably can't even conceive at this point! ■

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Vincent Di Fate

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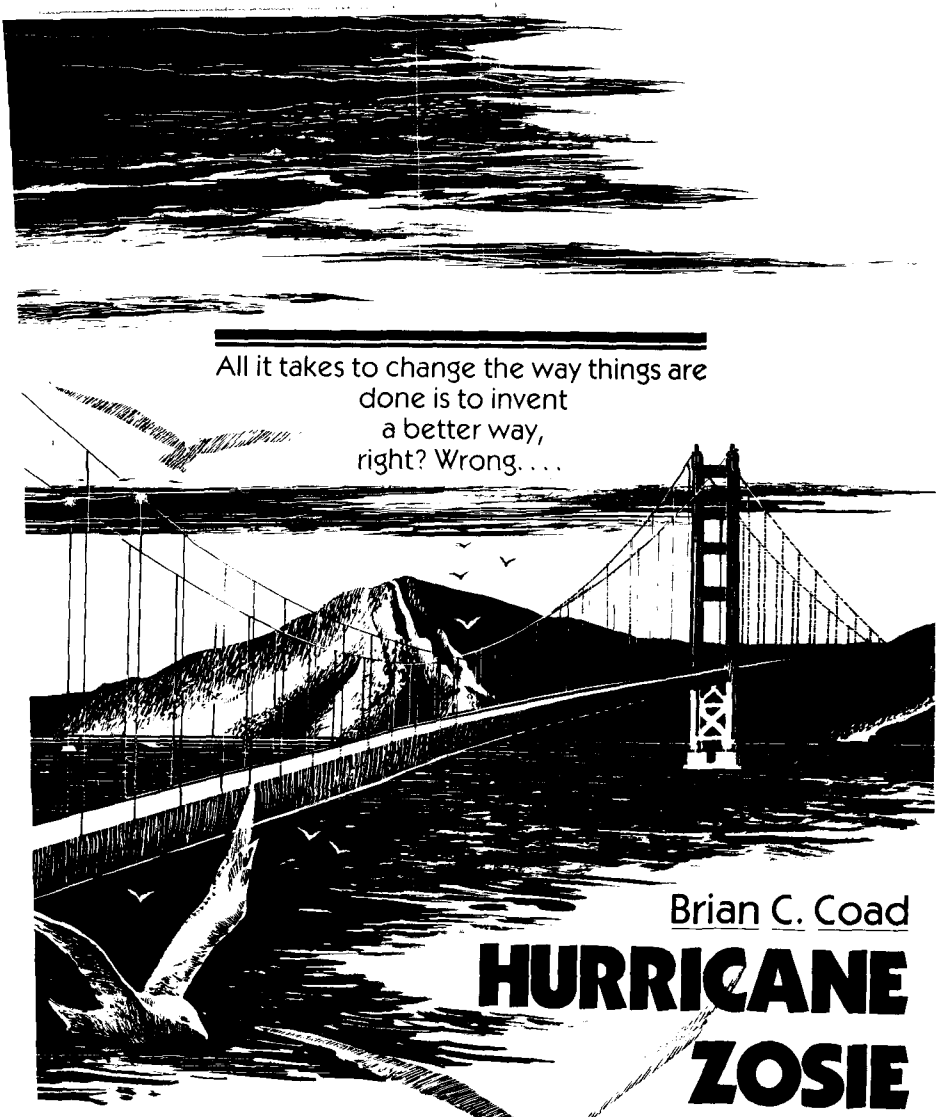

All it takes to change the way things are done is to invent a better way, right? Wrong. . . .

Brian C. Coad

HURRICANE ZOSIE AND THE CONTROVERSIAL SCOTSMAN

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1. THIRTY MONTHS OR SO PRE-ZOSIE TIME.

It was one of those bleak winter's days when nature's howling winds and blizzards have shut everything down—the growth of grass, the migration of beasts, the creativity of the human species. I sat restless in my Connecticut office, half way up G.B.I.'s Corporate Tower, no patents to file, nothing to do with myself. Like every year, I'd circulated a memo to corporate technical people saying for gosh sakes invent something to help me fill this slow time. Like every year, they were hibernating, and sent me nothing. Outside, it was already getting dark. I was tempted to go home early, get out my reflector, and see if a spell of stargazing couldn't improve my mood. But then I looked out at the smothering grey clouds hanging over the world like the roof of a tomb, and knew that idea was a washout. What I should have done to get through the null winter months was grind a new telescope mirror. Asshole, I told myself. You didn't even buy yourself the necessary materials.

Ms. Lee came in, apologizing for interrupting my important meditations. "Some very late mail has just arrived. I thought you would like to see it."

My well-beloved secretary is of Chinese extraction, but she is not inscrutable. Clearly, something had pleased her. She beamed down at me as she plonked a thin bundle of papers into my in-tray, telling me, as though a miracle had just happened, "An invention disclosure has come in. It is from someone called Kyle McAilsh, of Montague Plating. I've put it on top." Then she practically danced out of the office.

Not expecting much, I picked up the disclosure. Kyle McAilsh. Someone I'd never heard of. Montague Plating. In the four or five years since they'd become a wholly owned subsidiary of ours (acquired to supplement G.B.I.'s electroplating capacity) I'd heard nothing from them. Hadn't expected to. Electroplating is too old a technology to generate interesting business for a patent attorney. Probably I'd get no more out of this than a few minutes' unproductive eye-strain to round out an unproductive day.

I glanced through the summary on the first page of the disclosure, and, although I tried, could no longer hold on to my depression. Kyle McAilsh proposed, with a new technology of his own devising, to make the whole art of electroplating obsolete. If his invention was real, it would be one of those breakthroughs that come only once or twice in a patent lawyer's working life, presenting him not only with a chance to write broad patent claims of such beauty, they'd be the envy of his peers, but also with an opportunity to generate a whole cascade of dependent inventions. Things electroplated marched before my eyes: can openers and a host of other domestic gadgets, car bumpers, little gold-plated goodies waiting to be assembled into computers and telephones. As well as the basic process patent, there'd be product patents galore. More work than I could handle for years to come.

I read on. The McAilsh concept was simple enough. He proposed, in a vacuum chamber, to boil his plating metal. Then he'd drop cold components through the resulting metallic gas. Atoms would

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condense on the components, and—*voilà*!—they'd be plated.

He listed advantages this method would have over electroplating. No messy chemistry. No hazardous chemicals to be handled. No environmental pollution from discharged washwater. And so forth. I was delighted with him.

I searched for process details, but they were absent. The last paragraph of the disclosure was a bummer. McAilsh committed the sin perpetrated by all too many novice inventors. He wrote: "I'm sure this process will work, but I have not as yet been able to reduce it to practice."

That may be true of a lot of inventions, but if it is, you never, *never* tell your patent attorney!

I reread the disclosure, and wondered why I'd felt so pleased about it. On second reading, it seemed sketchy and overly padded with redundancies. Moreover, there was something in the inventor's writing style—you know how it is with style, you get a sense of something more than is precisely there in the words—that had me feeling, bottom line, he lacked faith in his own invention. I almost felt he'd written into it a sort of subliminal scream: "Please, reject me!"

For reasons they've never confided in me, G.B.I.'s executive committee, whom I call the Six Hard Men—the ones who run the Corporation—elected, when Montague Plating was purchased from Wilkes Montague, its founder, not to integrate the operation into one of our divisions. It has remained a wholly owned subsidiary; legally, a separate company. For reasons still more obscure, they appointed to be its board chairman and C.E.O., our corporate vice president of planning, a man named Noonan. Noonan, whom I prefer to call vice president of confusion, is not a good friend of mine. I think he manipulated the Hard Men into giving him the job so he could claim he'd had experience meeting a payroll.

Anyhow, Noonan was top man for Montague, and unless founder Wilkes (a sick old man, but still around) had strong feelings about it, he alone would rule on the disposal of the McAilsh disclosure. I took it along to his office.

There was no welcome for me; Noonan doesn't believe in that kind of polite nonsense. From behind his enormous desk, he glares at visitors like a grouchy Richard Nixon with a head cold. I stared him down, gave him the disclosure, and, uninvited, took a chair.

Noonan mumbled as he read. "Piss on McAilsh . . . scatter-brain . . . wild man . . . starts big projects . . . can't finish them . . . runs off in all directions . . . no discipline." When he'd done reading, he threw the disclosure in my direction, and resumed his glaring. I refused to react. Presently he said: "That damn McAilsh would have been long gone, if it wasn't for Wilkes liking him, and him coming cheap." His expression challenged me to confess it was my fault McAilsh hadn't been fired. When I didn't, he went on: "We've put a lot of money into that run-down old plating shop out there in Berkeley. You think I'm going to support some weird new process that obsoletes our investment?"

For that argument I was prepared. "If there's anything to this, it'll be

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pretty important. Worth a lot more than your investment so far. It'll look bad if we miss it. Don't you think I'd better delve a bit deeper?" As well as the patent aspect of the business, there was at stake an opportunity for me to get away from snowy Connecticut for a few days, and soak up some Californian sunshine.

Noonan ignored my question. He reached into a drawer of his desk, extracted a sheet of paper, and thrust it under my nose. "McAilsh's a damn blackmailer. Read that."

What he'd given me was a hand-written note, signed by McAilsh. Its first paragraph comprised a summary of that young fellow's invention, including a list of its advantages over existing Montague technology. (Typical of Noonan, I thought, not to tell me he knew about this before I came to see him.) The second paragraph stated unequivocally that electroplating was unsafe for employees and hazardous to the environment. The third said, if Noonan wouldn't let him get his process patented, he'd go public on the hazards, and would see Montague Plating was infested forevermore with OSHA inspectors and ravening mobs of environmentalists. In the manner of an infantile extortionist, the memo concluded: "Don't you dare underestimate me! I've a lot of contacts and friends will help!"

Noonan's cheeks were puffed out as if he was smoking an invisible pipe. He was staring at the ceiling. I asked: "You have any OSHA or environmental problems out there?"

"Hell, no. Not since we modernized the plant. Still, if this idiot chooses to make a nuisance of himself, could waste a lot of time, get us negative publicity." His inflated cheeks popped, and he shrugged. "Ho, hum. I guess you'd better look the guy up, see what he has to say."

Feeling rather pleased that I'd managed to manipulate Noonan the manipulator, I returned to my own place, where I squandered time wondering why McAilsh had been so importunate in his memo, when his disclosure virtually demanded rejection.

Next morning the weather was much the same, but my mood was vastly improved. I had Ms. Lee place a call to Wilkes Montague, to let him know I'd be visiting. Wilkes and I had met when G.B.I. first took over his company; I'd gone out there on a prospecting trip. His plant at that time fitted Noonan's description of it—a run-down old plating shop. Regular nineteenth century, I'd thought, and Wilkes one of those Victorian, piss-in-the-plating-tank fossils, devoid of scientific training, utterly empirical. My visit had not been productive.

Ms. Lee took considerable time getting Wilkes, but at length he was on my line. He remembered me, or said he did, and apologized for being hard to get. He was in the hospital. I asked, should I put this off until he felt better, was back at work? No, he said, he did most of his business from his bed these days. When I mentioned the McAilsh disclosure, it was the first he'd heard of it, and I had to go over it for him. He listened attentively, until I'd finished, then said: "Son of a bitch, who'd have thought young Kylie'd have the guts to fuck off inventing things behind my back?" I said: "He may have something

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good. It's important for me to get with him. Is it OK for me to visit?" He thought for a while. Eventually: "Well, all right, Wally. But don't go spoiling our working arrangements with Kylie." He laughed. "Kylie's a masochist. He does his work fine, long as I bully him, tell him he can't do anything right, don't give him raises, like that. But anyone pays him a compliment or any of that shit, he turns in on himself like a cornered hedgehog. You can't get nothing useful out of him for months after."

I promised I'd be careful.

A week later I arrived at Montague Plating, and even before I'd parked my rental car, I was impressed. The plant was located amidst the industrial flatlands at the foot of the Berkeley hills, one of a host of similar long-established enterprises housed in run-down old buildings. Montague was run down no longer. The nineteenth century had given way to the twenty-first. The rickety old wooden shops I remembered had been torn down. In their place was erected a fine modern structure of mock marble which would not have disgraced any industrial park in Silicon Valley. Over the entrance, the words:

MONTAGUE PLATING
A SUBSIDIARY OF GENERAL BUSINESS, INC.

glowed blue and proud.

I drove around to the side parking lot, parked, noted some of the older buildings still hid shamefacedly behind the new one, grabbed my briefcase, and, still wondering how best to approach Kyle McAilsh, dodged raindrops—did I mention it was raining?—to the entrance. For days I'd been wondering how to approach Kyle McAilsh. Despite Montague's and Noonan's portrait of him, I felt a certain warmth towards him. He was, after all, an inventor. Clearly he was also a complex character, and the situation would require delicate handling. But I'd been unable to come up with any infallible plan of action.

I entered the Montague building.

In the lobby, the receptionist told me Wilkes was still out sick, so I didn't have to pay protocol respects to him. She had McAilsh come get me. He was expecting me (I'd had Ms. Lee tell him I was coming), and arrived quickly. He proved to be a tall, sturdy fellow, late twenties, starched white shirt, plaid pants, unusual bronze hair, a lopsided grin that at first sight was attractive. "Welcome, Wally Mason." He shook my hand, looked me up and down. "Wally, ye're gettin' fat. I hope your wee brain isna' as flabby as your guts." Gruff voice, Scottish accent that didn't quite sound real.

So much for my planning! I flashed back: "We've never met. How do you know I'm getting fat?" Simultaneously, I shot a wary glance towards the receptionist, whose pretty ears, I guessed, were stretched wide open to audit little goodies that might amusingly be relayed to the corporate grapevine.

"Seen your picture in old corporate bumpf." In McAilsh's voice there was a hint of a surly whine. "Well, are ye comin' wi' me?" He marched off, high energy movements, jerky.

I followed him, cautioning myself on the way not to be prejudiced. There's no rule inventors have to be nice people. Still, if some fellow lawyer had cross-

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examined me just then, he could easily have forced me to admit I was thinking the hell with compassion for inventors, this guy's a stinker, a phony all the way from his flat feet up to his pretty wavy hair.

McAilsh hurried me through the plating shops. Those shops' antecedents, through which I'd been guided on my first visit, had been grimy, smelly, steamy and chaotic, with a lot of unkempt, unshaven men in rubber aprons dashing around. The ones I now glimpsed in passing were more like electronic div's clean-rooms, spotless, well-lit, orderly. There was a lot of miscellaneous instrumentation I'd have liked to have inspected. A dozen or so workers, female, in white lab coats stood about with, it seemed, not much to do. Oddly, they turned away from us as we rushed past them.

My guide's judgment of my physical condition was on the mark. I found myself straining for breath to keep up with him. Hoping to slow him some, I puffed: "Everything automated now, huh?" (Gasp.) "And run pretty much by minority women. You're doing a good job" (gasp) "of conforming to equal opportunities regulations."

The desired effect was not achieved. Not pausing—moving faster if anything—he grabbed my arm, made serious eye contact with me. "My granddaddy told me dinna trust minorities or women! Ever!" He let me go again.

"Why not?" We were now sprinting up a stairway. I barely had breath to get the words out. He did not answer.

We entered a spacious workshop containing furnaces, welding equipment, and such. Along one side were several offices, none of which were, as far as I could see, occupied. Kyle ushered me into one of them. The desk inside had his nameplate on it. I took a chair. Asked, "You on your own here?"

"Yep." He seated himself behind the desk. He couldn't sit still—kept wriggling his shoulders, tapping his fingers on the blotter, and such. "We get technical help from time to time, but they never stay."

I bet they don't, I thought. There was tense silence until I blurted out my next obvious and inane question. "You're from Scotland?"

Kyle's answer gushed out as though behind it there was a terrible pressure of words, barely controlled, seeking release. "Am not. 'Twas my granddaddy came fra the auld country. I was born here."

So my ear had not been misled. His accent was simulated, not the real thing. (Yet, a curious note in passing, I've met more than one American of Scottish descent who carries the brogue even to the fourth or fifth generation.)

More to keep the conversation going than for any other reason (I had to gain his confidence and get the tension lowered if we were to get any work done), I remarked. "Your granddaddy didn't like minorities?"

"Ye canna read their body language or their faces. A person learns to read faces when he's a wee bairn, two years old. If ye're na' exposed to Asiatics and such by then, later is too late. That's why they all look alike."

"Oh?"

"Aye. 'Tis a survival mechanism left

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over from our time as predators on the African savannahs." McAilsh's eyes, restless as the rest of him, danced around. (He exhibited nystagmus, I think the medical folk would say). "If ye canna' read a face, said my granddaddy, dinna trust the owner, for he's competition."

"And women? Why can't they be trusted?"

"My granddaddy determined that they are of a different species. He discovered there's more difference in survival strategies between men and women than between most similar kinds of beasties. Rats and mice. Wildebeests and gnus."

"Wildebeests and gnus? Surely they're the same animal?"

For a moment his eyes quit dancing, and fixed on me. His fists clenched. I was glad his massive desk was between us. "Dinna accuse my granddaddy of being wrong."

"Of course not." I toned my voice as mild as possible. "He has some interesting ideas. I'd like to meet him."

"That ye canna do. He died. For me."

Like Jesus. The thought rushed unbidden into my head. "I'm sorry."

"Nae need for that, for in his death he showed he was a man. I was fourteen." He slumped in his chair. His fists came unclenched. His eyes took on a half-shut dreaminess. "Granddaddy'd put me to climbin' a high cliff, ye see, to toughen me up. Eighty foot up, I got stuck. I wasna' but a cowardly fool, just what he said I was. He come up after me, showed me where to step, and then he fell. I blubbered a' the way down, but I came down safe. I couldna help him."

Your stereotype engineer is stoic, unemotional, uninvolved in the messy human stuff of life, concerned only with his work. I'd never met one who fit the mold—besides being engineers, they're all human—but Kyle McAilsh fitted it worse than most. At that moment I'd have preferred to be dealing with the stereotype.

"You thought a lot of your granddaddy?" A stupid thing to say, especially as I sounded as if I was addressing, not an adult, but a ten year old. Which, perhaps, I was.

"He died to grow me up."

"Meaning you gained a strength from the experience you would not otherwise have had?"

"Of course I mean that." Kyle's voice regained its former gruffness. His eye movements started up once more. "My granddaddy said it's from your experiences only that you find out who you really are, so you must expose yourself to much experience."

"And have you done that? Have you found out who you are?"

"Not yet. I'm more than on my way."

"What happens when the process is complete?"

"Och, when a man's completely sure who he is, he's ready for death, and can die quietly, as my granddaddy did."

"Is that all there is to life?"

"Aye, that is all." He grabbed a pencil, and began to drum staccato rhythms with it on his desk.

The conversation died there. There was nothing left for it but to get down

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to business. At least I felt the tension between us had somewhat ebbed. I reached for my brief case, and extracted the relevant papers. Just then a puzzling afterthought hit me. "What about your daddy? Where did he fit in?"

It was the wrong question. "He didna' fit. He died young, of the whiskey."

"I'm sorry. Shouldn't have asked. OK, I have here the disclosure of your invention."

Kyle quit his pencil rattling and leaned forward. "I truly need a patent." The whine I'd detected earlier was back in his voice.

Probably, I thought, your granddaddy told you a man's not a man until he has a patent. I didn't say that. I said: "I'll do all I can to see you get one. There are just one or two difficulties, the main one being that you haven't given me nearly enough detail."

"I havena'? 'Tis simple enough. Think ye of zinc and cadmium refining and the boiling of water in kettles. If ye put enough kilowatts into any pot with a metal in it, there isna' any way the energy can get out but by the metal boiling, forming a gas. What you want coated's then only to pass through the gas . . . " his voice faded. "Ye dinna' look impressed, Mr. Wally Mason. Would ye like I gi'e ye a wee bit demonstration?"

"Yes. I certainly would." There were a lot of searching questions yet to be raised, but they could wait.

McAilsh took me out to the workshop, led me to a corner where there was a six-foot diameter dished vessel with spluttering pumps in action, a vacuum chamber. With much thudding of valves and hissing of ventilation, he opened the chamber to air. Within, there was a standard induction heating coil of water cooled copper, tiltable, embracing a melting crucible. "We melt here the electrodes for the plating baths," Kyle said. "Mostly gold. Twa hundred pounds the melt. Does that impress ye?"

I said it did. Meanwhile he'd placed in the empty crucible a black pot— presumably of graphite—with a screwed-on lid and a spout projecting beyond the top of the crucible. He named it his wizard's kettle. It had copper in it, he said, waiting to be boiled. "Could be gold, but copper's fine and cheap for a demonstration."

From an arm penetrating the chamber wall and manipulable from outside, he suspended on a wire a two inch diameter steel washer. He checked several times the movement of the washer, bringing it close to, and moving it away from, the spout of the kettle. He closed the vacuum chamber, set the pumps gurgling again, and we waited.

Soon the gage on the control panel told us we were in the hundred micron pressure range, which was the designed capability of the pumps (Kyle telling me this as we went). "We ha' a hundred kilowatts in the power supply," he said, turning it on. "The coupling willna' be good, but 'tis eno' ta boil a monstrous lot o' copper."

I was able to watch through one of the observations ports of the chamber, Kyle watched through the other. Presently, from the spout of the kettle, there emerged a greenish purple luminescence. "The copper's comin'," Kyle said. The stream of copper gas—I as-

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sumed that was what it was—grew in intensity. Presently Kyle was satisfied, eased back the power input to just hold the gas stream steady, and then, with the manipulator, flashed the steel washer through it. "Demonstration over." He turned off the power.

We had to wait until the graphite "kettle" cooled before we opened the vacuum chamber, or it would have burned like so much coal. During the waiting time, Kyle paced neurotically around the workship, fiddling with one thing and another. He made no offer to show me anything, merely left me standing idle by the chamber. I was rather glad to be left alone. There were a lot of things I could have said to him, but none of them, I thought, were likely to be helpful.

In due course, Kyle came over, checked the control panel. "Good enough." He opened the chamber. He brought out the washer, examined it, said: "Not bad, not bad," and handed it to me. It wasn't bad, it was terrible. The washer was coated with copper, but the coating was a mess, some of it powdery and non-adherent, some melted in blobs. I knew then that I would not be filing any patents. The McAilsh process simply did not work.

Kyle guided me back to his office, saying: "Ye dinna seem impressed. Ye're against me, like everyone else, as my granddaddy said it would be. Has it not been enough for ye to see the wee atoms flyin' "—flying, I thought, like the not so wee granddaddy's thoughts in your head—"an' fallin' where we want them? There's one or twa details of improvement yet needed, but there isna' a problem we canna' deal with—"

"No problems we can't deal with," I echoed, as he took his place behind his desk, and I sat down.

McAilsh talked at considerable length, but I'm afraid I didn't listen. He'd, by his demonstration, forfeited his claim to my attention. Wilkes Montague, however, would have been pleased with me. I offered him not a single compliment.

As soon as I reasonably could I took my leave, taking with me, as evidence to be used later, the disastrously coated washer.

Back home with the cold and the snow, I did enough research on the evaporation and condensation of metals—talked to a few experts (not in zinc and cadmium, in electronics applications). One good thing here in America is our knack of networking—an hour's work will put you in touch with almost anybody—makes you feel like you live in a village instead of a vast nation. My experts told me a lot about mean free paths, and inability to coat around corners, and such, and came to the unanimous conclusion that the McAilsh concept couldn't possibly work. Their opinions, added to the evidence of the washer, gave me all I needed to recommend to Noonan that we take no further action in the matter of the McAilsh patent.

Noonan proved to be more of a weak-kneed sister than I'd thought he was. Despite the overwhelming evidence against doing so, he still wanted me to file. I told him quickly enough that anyone who files for protection of inventions he knows won't work is committing a fraud on the patent office, and is sub-

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ject to grievous penalties. He backed down.

Later, I telephoned McAilsh with the bad news. He said (yet sounded relieved!): "May my granddaddy in heaven forgive ye!" I said I hoped he would, and hung up.

It would have been nice, after that, if I could have put Kyle McAilsh and his affairs out of my mind forever. Unfortunately I couldn't. First of all, I began to hear muffled titters behind my back whenever I left my office. It didn't take long to discover McAilsh's initial remarks to me, much embellished, had reached the corporate grapevine. After I'd lived that down, I'd still catch myself, in idle moments (of which there were fortunately fewer and fewer as winter gave way to spring), thinking of the man, and wondering what really made him tick. Obviously he was the victim of abuse by a tyrannical grandfather, but did his problems go deeper? I put on my shrink's cap—most of us legal people fancy we're blessed with unusual competence in the field of psychology—and wondered if he was, perhaps, a manic depressive. Certainly he had the brusque movements and the high energy of one. . . .

I'm pretty aware of my own psychological quirks, and soon recognized my analysis of McAilsh was no more than a rationalization, set up to defend me from the self-accusation that I'd too hastily consigned his invention to the dead files. It was certainly possible that the all-too-obvious problems of his process could, in fact, be resolved. I indulged myself in brief orgies of guilt, telling myself I'd permitted prejudice to prevail over clear judgment. Eventually, I called one or two more experts. Fortunately their views confirmed those of my previous consultants, and I allowed myself to conclude I'd not been seriously derelict in my duties.

I'd thought that was the end of that, but then a new thought entered my head and began rattling round there. If McAilsh really wanted his patent, why hadn't he followed through on his attempt to intimidate Noonan? Why hadn't he brought OSHA and the environmentalists down on us, as he said he would?

That mystery remained, unresolved, for me to brood over.

2. STILL PRE-ZOSIE TIME, A BIT LATER.

Well into the spring season, a fat piece of mail with Kyle McAilsh identified on the return address, was delivered to my office. Ms. Lee took it to be personal, and didn't open it. I mustered my courage (thoughts of letter bombs and such hovered at the edge of consciousness) and opened the package. The first thing that came out of it was a brief epistle, authoritatively printed in long-hand, informing me that since my visit to Montague, he, Kyle McAilsh, had suddenly become a celebrity, and would I please take note of it. As a celebrity, he deserved better of me than he'd received so far, and I'd better reopen the question of his patent, or else. The second thing that came out was a video casette with a label on it stating it was a bite from a local newscast of last Friday's date, all rights reserved.

I took the tape home that evening, and played it. It wasn't very long—five minutes at most. It wasn't all that impressive. I certainly didn't recognize

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that it would be enough to launch McAilsh into his fifteen minutes of fame, which, by good luck and good manipulative skills, he'd manage to parlay into maybe an hour and a quarter. But it was.

At that time there was a group of animal rights activists making a big fuss about furs, urging people not to wear mink coats and such. They still are, I imagine, though I haven't heard so much from them lately. Kyle, whether by some trick of the lighting, or some trick of the director's, looked pretty good on the screen. He reminded me of one of those well-groomed politicians who's learned to fake sincerity. If the anti-fur people have their way, he said (I'm summarizing), there's nae much hope for the survival of mink and similar beasties. Now the wee creatures are living in luxury on fur farms. If there's na' profit to be made from them, och, the farmers will murder them all. If there's na' economic incentive to keep alive the ones in the wild, how long d'ye think they will last? If it's to maximize the mink population of the world you're seekin'—and that's what ye're after, are ye not?—ye should urge every chill body of us to spend each winter wrapped in mink.

Good thinking, McAilsh, I thought. This'll stir up some controversy. This'll sure bring trouble down on your pretty bronze head.

It did and it didn't. My personal network told me the TV station that aired McAilsh received numerous phone calls and several dozen letters, some supportive, most not, many obscene. There was picketing. The station's management was ecstatic. TV folk (it's why they put out controversial stuff) have an unquenchable thirst for validation. They don't care whether audience response is positive or negative—strokes are strokes, as Dr. Eric Berne pointed out—just as long as there is a response. McAilsh, it seems, generated for them a record volume of validation.

(I never did discover, by the way, just how he managed to get himself tube time. Perhaps some reporter, happening to see him on the street, recognized his potential, and recruited him. Maybe it was another of those personal network things. Or it could have been the granddaddy in his head forcing him to attempt it, and persist until he had it made, planning to use his notoriety to force me to write his patent.)

A week later I received another letter, another tape. The second one was a bit longer, and included an introduction by a young lady of charm: "Here to present his views on another hot topic in the news, the controversial Scotsman, Kyle McAilsh."

Someone clever had recently calculated that the life span of one child in four thousand would be terminated (not necessarily cut short) by cancer resulting from eating apples sprayed with a certain pesticide. There was a lot of hubbub and outrage. The controversial Scotsman said: "Dinna get your dander up. Think clear. Twenty-five hundred of your four thousand children are going to die of cancer, as well as the one the apples get. I'd advise ye to be nice to apple growers and other farmers. If ye anger them to the point where they willna' mair struggle with the soil to feed ye, why, then, where will ye be?"

That effort of his worked, too. There-

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after, the controversial Scotsman was a regular feature, and I received a weekly package from him. The professional quality of his presentations never ceased to astonish me. His manic depressive, or paranoid, or whatever they were, characteristics were suppressed, and he exuded charm even when the words that came out of his mouth were, in my opinion, obnoxious. I assumed he'd had the good luck to fall into the hands of an extremely competent handler.

Week by week McAilsh alienated larger and larger groups of people. He had the temerity to criticize whales. When there was a big oil spill off the Pacific coast (more than adequately covered by the media), he mentioned that if the energy wasted in covering it had been conserved—print, paper, TV signals generated, TV signals received, and so forth—at least a couple of other oil tankers would not have had to be at risk. He told people striving to protect the wilderness they were elitists, "wantin' to keep the wilds wild for the wee minority who're privileged with free time to go there." There was plenty more, but you'll have gotten the idea by now.

With each tape McAilsh included a scrawled note advancing his opinion that now that he had become a person of importance, I could put him off no longer. He wanted his patent, and dire consequences would follow if he did not get it. He did not, however, use his media access to go public with his plea. I disagreed with almost everything he had to say, and refused, naturally, to be influenced by his arguments and threats. But I continued to view his tapes.

In a few weeks, the controversial Scotsman became less controversial. After all, there's only so many disputable topics out there, and he was soon scraping the bottom of the barrel, focusing his quibbles on the exaggerated hand gestures with which celebrities on TV emphasize their points—"like ham actors playin' comic Italians"—and other topics similarly trivial.

During the third month of his notoriety, McAilsh, hanging his thesis on recent negative American and positive Japanese trade statistics, attacked our great corporation (or rather, its management). "I work in the manufacturing industry, for a company called G.B.I. 'Tisna' a shameful thing to do, for we, as well as the farmers, feed ye, but I am ashamed of the rascals who run the company, or pretend to. 'Tis they and their ilk give us the troubles we're in. I call them the magnetic personality mob, for they attract authority and repel responsibility, which I suppose is what ye must do to succeed in American business. I also call them Haw, Haw, Haw men. They sit anonymous behind computer screens pressing keys that without our consent, or even knowledge, push the rest of us around. As they work, they go 'Haw, Haw, Haw.' "

That one, I didn't like at all. I thought the Haw, Haw, Haw part of it may have been directed at me. Noonan didn't like it either. I don't know how it came to his attention—I'd not put it past him to have been monitoring my mail. When he'd thought about it for a day or two, he sat down behind his computer screen, pressed a few keys, possibly went "Haw, Haw, Haw," and had Kyle McAilsh fired. (Wilkes Montague, by

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the way, still sick, was told merely that Kyle had resigned. Thereafter he referred to his former protégé as a damned deserter.)

Oddly enough, although he was now separated from the company, McAilsh continued to send me tapes. I suppose I could have stopped them simply by letting him know, now that he was no longer an employee, rights to any invention of his reverted to him, and had nothing to do with me. For some reason, I didn't do that.

Oddly enough, too, McAilsh launched no further attacks on G.B.I. nor its management. He had bigger game in mind. Perhaps he was aspiring to national notoriety, instead of the mere local glory that so far was his.

In the first of his new style tapes he attacked the erosion (he claimed) of liberty in America. ("My granddaddy in Scotland fifty years ago had more freedom than ye ha'e here the noo. I blame this sorry state of affairs on immigrants. They come fra' countries that ha'e not much of freedom. What they experience here is so much better than they had, they dinna see the need to fight to keep it.") Then, there being controversy at the time over a candidate for appointment to the Supreme Court, he took on the law (and the English). ("Och, the English canna' be trusted, for they set up long-term strategies. They gave ye Common Law, to keep ye arguin' and make lawyers rich. When ye were colonies, they made ye adapt written Constitutions, which further tangled ye up wi' the lawyers. Ye speak of the Rule of Law, but there is no such thing. There is only rule by the unelected bods who administer and interpret the Law. If it were not so, why the fuss over appointing a Supreme Court justice? Ye've been set up by the English for self-strangulation, so that over the centuries ye willna' be competition for them.") When the presidential election campaign began to get under way, he had something to say about it. ("Whoever ye elect, watch out for foreign wars. Those secret books government people read ha'e on page one, 'If ye canna' handle your domestic problems, go to war'. From time immemorial, governments have done that. Ye can expect yours to follow the tradition.") He had something to say about political leaders in general. ("Now Mr. Gorbachev has ended the East-West antagonism, ye're goin' to find yoursil's in trouble. The leaders of the nations of the world ha'e more in common with each other than they have with their ain people. From now on they'll cooperate to help each other control the people, and keep theirsil's in power. Where does that leave ye?")

One of his presentations did rather appeal to me. For some reason, it reminded me of my best inventors, who tend to work alone, circumvent the bureaucracy, and produce innovations neither planned nor dreamed of by management. The tape was date-lined St. Andrew's Day. Its content, no doubt, was a legacy bequeathed McAilsh by his granddaddy. He claimed Scotsmen invented the modern world. ("I gi'e ye a few names. Adam Smith. James Clerk Maxwell. James Watt. Alexander Graham Bell. MacAdam. Livingstone. All good Scots. 'Tisna from great empires that great civilized advances come, but fra' sma'

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nations—the ancient Greeks, the Elizabethan English (Elizabeth was a good Scot, for was she not cousin to Mary Queen of Scots?), Americans in 1776, and of course we of the bonny Highlands."

Well, he never managed to be controversial enough to get on the national grid. And then he made a major mistake. He attacked the I.R.S. ("The Internal Revenue Service is the only body of men ye permit to judge ye on the presumption that ye're guilty, and compel ye to prove your innocence.") There were a couple more tapes after that, bland and unimportant, and he vanished from the airwaves. I received no further communication from him. Friends in San Francisco told me he'd been arrested. For what? For cheating on his income tax!

A while later, there was a rumor on the grapevine that he'd become a homeless person, had been seen begging on the streets of San Francisco. That, I discounted completely. Kyle McAilsh was, after all, a qualified engineer, and would have no difficulty getting a job.

Months passed, I kept busy, and he dropped out of my consciousness.

3. ONE DAY PRE-ZOSIE TIME.

It was early morning in mid-July. I boarded a plane to fly west to San Francisco, to attend the annual colloquium of the astronomy section of the A.A.A.S. Only Ms. Lee and my boss, Tommy Smith, knew my destination. For a week I'd be on vacation, a free man. There was only one small (literal) cloud on my horizon. Hurricane Zosie.

Pacific coast hurricanes are common in July. Mostly they form south-west of Baja, coil violently in on themselves for a few days, and then, driven by summer high pressure over California, they meander westward to expire harmlessly over the ocean north of Hawaii. Only once in many decades will one of them find its westward movement blocked by an oceanic high. Then it may wobble northwards along the Pacific margins of North America, usually staying at sea, but sometimes coming ashore. Such a one was Hurricane Zosie.

Zosie was forecast to come ashore in the neighborhood of San Francisco Bay just a few hours after I was due to land at SFO. I was a little apprehensive, but not particularly worried. The forecasters reckoned she'd be downgraded to a tropical storm by the time she made landfall. There'd be heavy rain, but San Francisco buildings, designed to withstand earthquakes, should have no trouble coping with the winds. My only real problem was, would we have landed before she struck?

As it turned out, we did. At ten o'clock on Zosie morning, the SFO sky was clear, winds were light, and the day was pleasantly cool. I took an airport limousine to the Hilton, downtown, where the colloquium was being held, checked in, registered for the colloquium, and spent a pleasant afternoon puttering around the city on foot (San Francisco is a walking city). As the afternoon wore on, clouds, not yet too angry, began to gather in the southwest. From the Embarcadero pier I watched small wind gusts, the ones old time sailors called "cat's paws," dashing across the waters of the Bay.

By the time I'd tired of walking, and had returned to the Hilton, Zosie clouds,

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black and sullen, were scudding across the sky. I had dinner in the restaurant at the top of the Hilton Tower, where she did the worst thing she did to me all night—blotted out the view.

Neither in the afternoon nor in the evening did I think of Montague Plating. I did not think of Kyle McAilsh. I did not think of his patent. I did not wonder what he might be doing while I wandered around San Francisco. It was only later, and piecemeal, that I discovered what he was up to while I was not thinking of him. Since it's a factor in the history of his patent, and to keep the chronology straight, I'd better step aside here and put on record what I learned.

Kyle McAilsh had become some sort of agency worker, and now spent his time helping the homeless! Unbelievable? I wouldn't have believed it, had I been told. Nor would I ever have expected to meet a couple of people he was trying to help. They were called Mary Virgin, and Whoozie, and if any two people deserve to be remembered, they surely do.

Whoozie was small, thin, raggedy, smelly, with an unkempt beard and straggly hair hanging down from his dirty old cap, and white hands that flashed about on their own, making patterns like twining snakes as he walked the streets. His principle venue was the upper end of Telegraph Avenue, in Berkeley, where weirdos, students and visiting tourists blend. There, all day most days, he'd hustle along with short, crisp steps, eyes down, hands flashing, bothering no one. Nevertheless, most folks, even the weirdos, kept their distance from him. If at, say, a traffic light, you were trapped into standing for a moment near him, you might hear him mumbling: "Friend, my name is Whoozie." He'd not look at you, not expect any response from you. If you spoke, you'd get nothing more from him. Then the light would change, and he'd hurry on about his business.

For some weeks, Kyle McAilsh had taken a special interest in Whoozie. Several times he'd approached him to let him know there was help available if he'd accept it. The most he'd ever got in return was a watery-eyed glare, and, "Friend, my name is Whoozie." Kyle was tempted to give up on the poor alienated derelict, but he kept on trying.

Whoozie did have one human contact, Mary Virgin. Every day Mary, wearing a tattered blue robe, squatted in a little street niche between two buildings close to Cody's bookshop, protecting a shopping cart that overflowed with drab linens, hanging strands, tassles, and such, amongst which nestled discarded cans, empty coke bottles, pretty stones, and even a few seashells. Mary begged with a blue plastic cup, and spat like an angry cat at anyone who dropped a coin in it, particularly if the donor was male, and came too close. "Keep your distance," she'd hiss. "My name's Mary Virgin, and I aim to stay that way." When Kyle approached her, he'd received the same treatment. His attempts to help Mary were no more successful than his attempts to help Whoozie.

Whenever Whoozie grew tired of parading up and down the avenue, he'd come and sit by Mary. Mary'd spit at him, too, but not for long. They wouldn't talk, but Whoozie would be tolerated.

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After a time—Kyle had often seen this happen—Mary'd scoop out the contents of her cup, count what she had. If it wasn't enough, she'd rummage under her robe—careful always to maintain respectability—pull out a few more coins, and give them to Whoozie. Whoozie'd get up, be gone for a few minutes, and return with a hot dog, or a hamburger, which they'd share. Kyle fancied her shopping cart contained Whoozie's possessions as well as her own. Certainly Whoozie had some worldly goods stashed away somewhere. At least once a week he had on a different shirt, not a clean one, just a different one. Whoozie and Mary, Kyle thought, probably had a secret nesting place somewhere or other in the city, to which they nightly retired together. Certainly he'd never seen either of them on the avenue after eight or so in the evening. He still worried about them. Their shelter was sure to be inadequate. But they consistently refused his help, and there wasn't much he could do about it.

More than twenty-four hours before hurricane Zosie arrived, Kyle, like everyone else, knew she was on the way. There followed, for him and his associates, a frantic period of collecting homeless people and bringing them to safe shelter.

Although Kyle, purposely or in the course of tracking down others, passed Mary Virgin's niche several times during that hectic time, he never found her there. Nor anywhere else. Nor could he find Whoozie.

Evening approached, with only two or three hours to go before the full fury of the storm would hit. Already dark clouds, roiling and ominous, blackened the south-western sky. Gusts of hot, humid air, harbingers of great winds to come, set stray paper and other garbage fluttering down the streets. Kyle, in an agency van, drove slowly for one last time along an almost deserted Telegraph Avenue, to make sure he'd missed no one needing help.

And suddenly, close to Cody's (where the windows had been boarded up) he saw Whoozie, still as a statue, leaning into the wind.

He drove up to him, slid over to the passenger side, lowered the window, leaned out, and was duly greeted: "Friend, my name's Whoozie."

"Yes, I know."

Whoozie looked up at the sky, looked down, turned on the snaking motion of his hands, and then—it was the first time ever—looked directly at Kyle. "I figure she's going to rain some. You're a good-lookin' young fellow. Bronze hair. Yes, sir. I figure she's going to rain some."

"Ye're not wrong, Whoozie." Kyle opened the van's door. "Come in here, and I'll carry ye to a safe, dry place."

Whoozie continued to stand motionless, staring off into space. Kyle spoke sharply. "Come on, laddie. Look, a wee rain's already begun." There were, indeed, damp splats forming on the sidewalk. " 'Tis gettin' dark and the wind gusts are rising."

"You speak funny," said Whoozie. "You some kind of foreigner?"

"Never mind that now. You can trust me. Just get in the van."

"Been looking for Mary. Maybe she's gone home." Whoozie's head

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jerked around like a bird's looking for predators.

"I can take ye home. If she's nae there, we can drive around until we find her."

Whoozie's hands stopped snaking. He made a decision. "Right on, mister. You can take me home." He climbed into the van.

Had there not been Mary to consider, Kyle would then have driven directly to one of the shelters. But he had to do what he could for Mary, too. Where, he asked, is home?

"Down on the flatlands. Drive down Dwight. I'll show you."

Whoozie's maybe not as hopeless a case as I've been thinking, thought Kyle, as he put the van in motion.

Presently, on Whoozie's instructions, he crossed San Pablo Avenue, and entered a familiar neighborhood. "I once had a job near here," he said. "In fact, over there's the very plant where I used to work."

They were approaching, of course, Montague Plating.

"You used to work there?"

"Yeah. Which way now? Down past the Montague parking lot?"

"Funny," said Whoozie. "I never had a job."

Kyle came to a stop, awaiting directions. He could see several cars in the parking lot, one of which pulled out and passed them. Light blazed from windows along the now visible side of the building. Kyle said: "Wi' all them on swing shift, business, I'm thinkin', is good." He turned to his passenger. "Well, Whoozie? Which way?"

"Straight on down. Then bear left. There's some old buildings."

"In back of the property? A wee while ago, Montague was going to expand into them. They're not yet torn down?"

"Don' know nothing about no Montagues nor no expansions. Just know some old buildings, and a hole in the fence."

"All right, Whoozie. Let's go find your hole." Kyle drove on.

In a minute or so Whoozie motioned him to stop. Kyle parked by the curb, under a street lamp that silvered the leaves of skimpy weeds growing on the sidewalk. Whoozie got out of the van. Kyle followed. Whoozie guided Kyle to the hole in the fence. It was a large hole, easy for Whoozie to get through, amply big enough for Kyle. Whoozie led him to a stairway running down to the basement of a delapidated and ancient wooden structure near the fence. At the top of the stairs—Kyle recognized it, even though there was minimal light from the street, and the rain was now falling in earnest—was Mary's shopping cart. Whoozie mumbled "Lucky I'm home before all our stuff's got wet." He siezed the handles of the shopping cart, and bumped it down the stairs. Kyle followed. At the bottom, Whoozie straightened up and faced Kyle, his back to a warped door with paint peeling off. "The poor girl's not strong you see. She finds me useful." He turned and opened the door.

Inside, over Whoozie's shoulder, Kyle saw, by the light of a kerosene lamp, Mary seated on a kind of chair made from an old fruit crate, in a kind of room constructed from hanging blankets. A carpet of rags covering its floor. Mary had an open book—the bible?—on her

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lap, from which she was reading. In one corner, two higher piles of rags made kind of beds. The place was stuffily hot, the air acrid with a cattle shed odor.

Whoozie pushed the shopping cart into the room. Kyle followed him in. Whoozie closed the door. Apart from the unhygienic stench, this old building wasn't too substantial. Kyle thought of trying to persuade Whoozie and Mary to come away to a shelter. But he was a realist. He knew there wasn't much chance, and he did have other responsibilities to attend to. He contented himself with asking: "Do you have any food?"

"Sure do," said Mary. "What kinda people you think we are?" She pulled aside a kind of curtain beside her chair, and there were maybe a dozen cans of various stuff, Kyle could not see precisely what.

"Then I'll leave ye. One thing. As I told Whoozie, I used to work here. I'm advising ye not to go wandering around in the other buildings. There's toxic chemicals stored."

"And rats," said Whoozie. "There's rats in them other buildings."

"I'll come back to check on ye when the storm is done."

"Don't you go coming back here," Mary said. "Specially not when my friend's not here. My name's Mary Virgin, and I intend to stay that way."

Kyle grinned. "Good for you. You can keep the door locked. But I'll surely come when the wind stops blowing and the wee rain is over."

With that, he left them, making sure the door behind him was safely shut against the storm. Outside, he noted there was a storm drain at the bottom of the stairs. At the top, a concrete berm six inches high surrounded the stairwell. He did not think there was much chance they would be flooded.

He went out through the hole in the fence, and drove away through intermittently heavy rain, to get on with his other chores.

4. IMMEDIATELY POST-ZOSIE TIME.

And now back to me. Zosie was powerless to inconvenience me in the safe shelter of the Hilton Hotel. She came ashore on schedule, a bit before midnight. I was asleep. A bit later, I woke up and heard winds whistling in the night, rain driving against windows. My hotel room trembled a bit, but it wasn't as bad as a minor earthquake. By eastern standards, after all, she really wasn't much of a storm. I heard later that the power went off for a while around two o'clock, but that didn't affect me. I'd gone back to sleep.

In the morning the wind had abated, but it was still raining. No problem. Power was back on. I had breakfast in the hotel, and attended the morning sessions of the colloquium, which proceeded independent of the weather.

In mid-afternoon trouble descended on me. I was sitting in the front row of a spellbound audience hearing a fresh-faced young astronomer report on his new observations of the peculiar star, Eta Carinae (super-massive, two hundred solar masses, expected at any moment to do anything from becoming a super-supernova to vanishing from the Universe).

A uniformed bellboy (they go by a different name nowadays, but the hell with it, I'm old-fashioned) came up to

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me, whispered my name—"Mr. Mason?"—and spoiled my concentration. It was on the tip of my tongue to tell him to go away and bother me later, but I managed a polite "Yes?" I hope he appreciated the glare that went with it.

"There's a person in the lobby who insists she has an urgent message for you."

"I'll be along in a few minutes. When this is over." We were whispering, but several of my neighbors eyed us angrily.

"The person is extremely insistent, and intends to come in here for you if I don't bring you out."

"Oh, very well." I stood, and followed the bellboy from the hall. On the way out, I wondered who could have a message for me. Only my boss, Tommy Smith (apart from Ms. Lee, of course—but she'd never tell!) knew where I was. He'd not interrupt my vacation except in an extreme emergency. Silently cursing the bellboy, I permitted myself to wonder if some exotic female industrial spy—he'd said "she"—was after me, intent on stealing intellectual property from the corporation. Perhaps I was about to be kidnapped, seduced, and—

But no such luck. "She" turned out to be a bike-messenger girl, one of those shapeless little darlings who flash along the sidewalks of the city, terrifying pedestrians. Of indeterminate age, with cut-offs, rimless glasses, one of those funny mini-hardhats, and an intent, if innocent, expression. The poor creature awaited me, dripping puddles on the lobby carpet. She handed me a slim envelope, which was dry, and a clipboard, which wasn't. She said: "Sign, please." I made mushy marks with a pencil on the pulpy clipboard sheet. Handed it back to her. She left.

The bellboy was still hanging around, waiting, I suppose, for a tip. I didn't give him one. As I sank into one of the lobby fauteuils, he slunk away. I extracted from the envelope a single sheet of paper with a faxed message on it.

The message was from Noonan. Typical of the man, I thought, to communicate by fax and bike messenger, when he could just as easily have telephoned. His concept of high tech! More likely, a ploy to get me to do something I didn't want to do, without giving me a chance to say no.

The message read:

DISASTER AT MONTAGUE PLATING. HUNDREDS BELIEVED DEAD OF CYANIDE POISONING—MOSTLY SEA GULLS, BUT AT LEAST TWO HUMANS. SORRY TO BOTHER YOU, WALLY. I GOT YOUR LOCATION FROM TOMMY SMITH, WHO CONCURS WITH MY ACTION. PLEASE INVESTIGATE. ASSESS LEGAL CONSEQUENCES. RUMOR IS THAT DISGRUNTLED EX-EMPLOYEE, KYLE MCAILSH, MAY BE RESPONSIBLE.

It was signed plain NOONAN. Our good vice president doesn't believe in the intimacy of Christian names. Doesn't believe in violating the command structure, either. By mentioning Tommy Smith, he'd in effect given me an assignment from my boss, circumventing any impulse I might have to ignore his instructions and go on about my business.

I thought of calling Noonan to get

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more details. It was after three, west coast time, six east coast. He'd probably be gone from the office. In any case, talking to Noonan was always, for me, a downer. Then I thought about calling Montague Plating, to warn them I was on my way. But thought better of it. It's been my experience that in legal emergencies such as this (not that I'd ever encountered one like this before) it's always better to go in cold.

So I went out of the hotel. No need of rain gear or an umbrella. The rain had stopped, and a watery Sun was oozing through intermittent scudding clouds. Besides, rain? In San Francisco, in July? I had no rain gear with me. At my request a bellboy waved up a taxi for me. He was the same guy who'd dragged me down to Earth from Eta Carinae. This time I tipped him. A quarter.

I gave the driver my destination, surely pleasing him, for the flatlands of Berkeley constitute a run almost as long as the airport. We sloshed away through streams of run-off water from Nob Hill that still gurgled in the gutters. We headed for the Bay Bridge. For the first time since I'd come west, I thought about Kyle McAilsh, and recalled my previous contact with him. I was not then aware, of course, of his recent activities.

We'd crossed the bridge, running through one or two small residual showers on the way. My driver, I'd noticed, had not borne left into the maze to head for the flatlands, but had kept straight on towards the hills. Was he, I wondered, taking advantage of me, and following a roundabout route to boost the fare? Would a cabbie do that? Not this one, apparently. He spoke over his shoulder. "Exits are flooded along 80. We have to detour some."

I grunted. Brought out Noonan's faxed message again. Two dead, plus some sea gulls. Cyanide poisoning. Nothing strange about having cyanide at Montague. A lot of their work was gold plating, usually done from a cyanide bath. Probably careless storage, inadequately trained employees, cutting corners on expenses, something like that. Probably Noonan's fault. But a potential PR catastrophe for G.B.I.

I'd better, I told myself, keep an open mind until I get the facts. We were running downhill now, going in the right direction at last, along a residential street with houses close together, and tiny lawns soggy and steaming where sunshine penetrated. There were a few blown-off palm leaves and clumps of twiggy debris on the street. Cyanide, I thought.

I remembered a wise old professor who, when I was a student, and long before I became a lawyer, tried to teach me the elements of the chemistry of gold plating. He had my measure as a chemist. "Cyanide, Mr. Mason," he told me more than once, "is dangerous stuff. If you are obliged to come into contact with it, you would be well advised to ask someone else to handle it for you."

I wished I had someone to whom I could delegate the handling of this mess. Not that, so far, I knew much about it. But I could see it was major trouble.

We pulled up in front of Montague Plating. As I paid off the cabbie, I saw a bunch of police cars further down the street, their lights flashing.

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I went inside the building. Advanced to the receptionist's desk. Confronted the same pale young woman with oversized glasses I'd met before. Sadie, I remembered. She blinked—pretending not to remember me?—checked on her telephone, and said Wilkes Montague was in his office. I could go right in.

Wilkes was usually laid up in his sick bed, so I'd really not expected him to be there. Following directions Sadie gave me, I went along to his place, entered. He looked as though he shouldn't have been there. Once a big, burly fellow, he was now slumped at his desk, a skin-and-bones wreck. Still, his eyes were sharp enough as they fixed on me, though his voice was no more than a husky whisper. "Thanks for coming, Wally. A bad business. A bad business. That's right, sit yourself down."

"You were expecting me?" It would have been an affront to ask him how he was. Or even to put him through the labor of shaking hands.

"Sure. Noonan said you'd be by to clear things up."

I would? To clear things up? "Tell me about it, Wilkes."

"Hadn't been for this damn storm, wouldn't have been no trouble. Seems we had some old bags of cyanide stored back in Building Thirty. Also some carboys of muriatic acid." (That's hydrochloric, for those of you not familiar with the obsolete term.) "Storm came. Roof leaked. Some of the carboys had their corks out. Rain poured in. Acid overflowed. Got to the cyanide. Made HCN. A bad business."

I could have said that's the sort of thing you expect in California. Roofs leak in California, especially those of old warehouses and such. Ask any cost-conscious facilities engineer why, and he'll tell you it's impossible to fix them. In the dry season, you can't find the leaks. In the rainy season it's too wet to fix them.

But I didn't go into that. I said: "There were casualties, I understand. Just how big a problem do we have?"

"A big one for sure, times being what they are. The toxic mess ran down a storm drain and out to the Bay. Dead sea gull bodies out there now, floating everywhere. Damned environmentalists scooping them up with butterfly nets. I bet any minute now them bastards'll be here picketing and exaggerating and causing a rumpus. Sons of bitches go out of their way to make our lives not *worth living, they get a chance.*" He was wringing his hands. No flesh on them. I imagined his life was not much worth living even when the environmentalists left him alone.

"There were some people killed?"

"Oh. Yeah. A couple of drifters. Come in through a hole in the fence and set up housekeeping in the basement of Building Thirty."

"You're not concerned about them?"

"Shit, they're not going to give us no trouble, not like the damn seagulls. I went down, saw 'em. Lying peaceful in each other's arms." (That was nonsense. Death by cyanide poisoning is a miserable death.) "Them two's better off now than they ever were."

I could have told Wilkes he'd better be careful, the law takes more account of dead humans than it does of dead birds. (At least, I think it does. You can never be sure nowadays.) In deference to the old man's frailty, I didn't. In-

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stead: "Any idea how the corks came out of the carboys?"

His skull-face came alive. "Sure. That son of a bitch deserter, Kyle McAilsh, took them out."

"How do you know that?"

"You met Hank Johnson? My money guy, keeps the accounts, and like that?"

"No. Where's he come into it?"

"Last night. Before the storm. Hank saw the bastard."

"McAilsh? Pulling the corks out?"

" 'Course not. Hank wouldn't be out back. Not his kind of place. A good front office guy, Hank."

"Then what did he see?"

"I'm telling you. Working late, like he does most nights. Drove out of the parking lot nine, nine-thirty. Saw McAilsh."

"Walking by?"

"Shit, no. Driving by in some fancy-looking official jalopy. You want me to take you back there, visit the scene of the accident?"

"Later, perhaps." I wanted to spare Wilkes the physical strain of walking through the plant. I wanted to avoid, if I could, viewing the dead. Dead people remind me too much of my own mortality. "You say Hank saw McAilsh driving by. How sure is he it was McAilsh? The seeing couldn't have been good."

"Hank don't miss nothing. He saw him, and he knows who he saw."

"Well, that's helpful. Maybe. What're the police doing? They've pretty much taken over your parking lot, their cars. Have they put out an all points for McAilsh?"

"Wally, you're sounding like one of them cheap soap opera lawyers on TV."

"Grasping at straws, Wilkes. If we can implicate the good Kyle, it just might help some. Just might."

"Oh, yeah, I remember. You an' him're old friends, right? Something else I remember. I told the cops that, and they said they want to ask you some questions about the bastard." Wilkes reached for his telephone, spoke into it. "Sadie, you want to get in touch with that there police lieutenant, Smythe, or something, tell him Wally Mason's here. Have him come up."

I could get nothing more of interest out of Wilkes Montague. In minutes, Lieutenant Smythe arrived, uniformed, moustached, plump. He said he wanted to know everything I knew about Kyle McAilsh. I said I'd be glad to help any way I could. He said he knew quite a bit already, McAilsh having once been something of a celebrity in the district. Wilkes said he had a bed in the back room behind his office, and would we think he was rude if he left us to our business? We said no. He left. The lieutenant told me McAilsh had lately become pretty much of a drifter, a pretty suspicious character.

I told the lieutenant what I knew about him.

When I'd finished the lieutenant took note of my hotel address, and told me to stay available. He said: "This McAilsh interests us a lot." His tone of voice told me he wasn't using the word "interests" in its dictionary sense of "excites favorable curiosity."

By then, it was too late back east for me to report to Noonan or anyone else. I went into the room where Wilkes Montague was napping, was all set to tiptoe out again without disturbing him,

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but he woke up. While he massaged the sleep from his eyes, I told him I was going back to the city, but would be available if needed. He thanked me for coming.

I went to the lobby and asked Sadie to call me a cab. While I waited I noticed a sort of buzzing noise coming from outside the building. This, when the cab driver opened the lobby door to announce his arrival, resolved itself into the chanting of a mob. I went outside. The police, still in attendance, had guided the chanters around to the side of the building, by the car park. There they marched up and down, making their noises. Signs bobbed in their hands—"LONG LIVE OUR PRECIOUS SEA GULLS"—and such. Just as my cab pulled away, some sort of a fight seemed to break out among them.

Zosie had gone on to Nevada, the sky was clear, and driving was normal, but we were just in time for rush hour traffic on the Bay Bridge. By the time I was dropped off at the Hilton, I'd not only missed three afternoon talks I'd wanted to hear, I'd missed the first of the evening sessions. I took in what was left of the day's program, then, not much inclined for company, dined alone at the Wharf. Soon after nine o'clock, I returned to the hotel, and went to bed feeling, with respect to the Montague catastrophe, that I wasn't doing much good so far. But I slept well enough.

5. TWO DAYS POST-ZOSIE TIME.

While I was shaving next morning, my telephone rang. Noonan for sure, I thought, eager to hear my report.

But it wasn't. It was Lieutenant Smythe. "We have Kyle McAilsh in custody."

"You have?"

"Yes. He turned up at the Montague plant yesterday. Just about the time you left."

"You had enough evidence to arrest him?" This could be good news for *G.B.I.* The best.

"No. He's in protective custody. He wants to see you."

"Protective custody? What does that mean?"

"If you come over, I'll tell you. We feel it would be helpful to us if you would talk to him."

Would it be a wise move to meet with McAilsh? The lather on my face was drying out, making it itch. I decided. "All right. I'll be there in an hour or so."

Breakfastless, regretting I hadn't rented a car, I went down to the street, got into another cab, and headed for Berkeley. San Francisco Bay was muffled in fog. It was a normal, rather chilly, July day. The roads were dry. Except for Kyle McAilsh being in jail, and two dead bodies in a morgue, all evidence of Zosie's visit was gone. My attitude on the way over was that of a prosecuting attorney. My job, as I saw it, was to help the police with their inquiries.

Inside the Berkeley police station, Lieutenant Smythe greeted me. "You won't mind if we watch your interview with the suspect on closed circuit?"

"He's still a suspect? I thought you said—"

"Yeah. He's not much of one. Only thing links him up is he knew the victims." Quickly the lieutenant gave me a summary of the McAilsh-Whoozie-

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Mary incident I've already recorded. "Not enough in that to charge him with anything," he added. "Fact is, we had to rescue him from being roughed up by that mob picketing the Montague plant. He says he was on his way to check on the victims. Didn't know they were dead. Saw the picketers. Stopped. Got out of his car. Was recognized by somebody—seems he has a fair number of enemies—and got himself a fair beating before a couple of my men dragged him out of it. Funny. He said the mob should have been beating up on his granddaddy."

I said I was sure McAilsh had plenty of enemies of his own.

Smythe guided me to an interview cell, an austere room with a slate floor, grey walls, a table, two chairs. Presently McAilsh was ushered in, and I was left alone with him. The McAilsh face was bruised and battered. His right eye squinted at me through greenish-black puffiness. I ignored his outstretched hand, gestured for him to take the chair on one side of the table. He sat. I was tempted to say you look like you should be in a trauma ward, but suppressed that instinct. I took the chair across from him. He wore old clothes, ragged and patched. I sniffed, but could detect no odor. He placed his elbows on the table, rested his chin on folded hands, examined me, shook his head from side to side. Finally, "Mr. Wally Mason, I need your help."

"I'm sure you do, Mr. McAilsh."

"You see, I'm alone now." There was only a trace of the Scottish brogue left. "I've finally killed my granddaddy, though, as you can see, they still visit punishment for his sins upon me." His eyes, as well as they could, twinkled. He looked up at the TV camera, not too well concealed in the ceiling. "I've finally killed my granddaddy."

"And those other two people? Did you kill them, too?"

"Aye. I shouldna' ha'e let them be where they were. I should ha'e brought them awa'."

His resumption of the brogue gave me the feeling, somehow, that he was toying with me. "Do you plan to give us a written statement to that effect?"

"For use by your PR people to save the corporate ass?" Ordinary American. "Nae, I willna' do that." Scottish again.

A sharper line of questioning was indicated. "You say you killed your granddaddy. You told me previously —you remember?—that was an accident. Perhaps it wasn't. Did you, in fact, murder your granddaddy?" He grinned, but did not respond. "And have you now, following your homicidal bent, gone on to murder two more innocent individuals by cyanide poisoning?"

He laughed. "Bravo, Wally. You should change your name to Perry."

"I must remind you, Mr. McAilsh, that this is serious business."

"It is, of course. Especially for the Haw, Haw, Haw men of G.B.I. But I see it's angerin' ye I am. 'Tisna' my wish to do that."

"What is it you wish to do?"

"Justify myself, I suppose. Find favor in your eyes. Explain how my granddaddy in my head once had me split in two, and let you see, now he's gone, I've become a whole person who knows who he is."

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"Which means, if I remember, you're ready for death. Why didn't you poison yourself instead of those two innocent people?"

"*Wally, Wally. You're still against* me. You'll have my paranoia back in a moment. Aye, I'm ready for death, or aught else. What I'm trying to say, I'm different now. Everything I used to do was my granddaddy's doing. Every word that came out of my mouth, especially when I was famous on TV, was a word of my granddaddy's. Then the I.R.S. ruined me—ye ken, I sent a' my spare kale to my grand-daddy's Scottish Nationalists, calling it charity, which they wouldna' allow—I was jobless, broke, and so far from what he'd instructed me to be, I couldna' do aught but kill him an' stand on my own two feet. Which, ever since, I've done."

"Good for you. I wish you wouldn't keep switching accents. It's disconcerting. Let's get back to the matter in hand."

"All right. Here's what I want you to do. I want you to get me my old job back. I want you to get me adequate funds to complete development of that invention of mine you rejected. I want you to file a patent for me. And I want to live happily ever after."

Sure you do, I thought. This is ridiculous. Outrageous. "You're in no position to make demands, Mr. McAilsh. That 'invention' of yours was rejected because it did not work."

"Only because I was so unconsciously resentful of my granddaddy's control of my life, I made it not work to aggravate him, dead though he was. Now I want to make it work. Not for myself. I want it to be a memorial to Whoozie and Mary. I want to help clean up the environment. I want to prevent other deaths from other accidents."

"Suppose we won't do what you *want*?"

McAilsh shrugged. "I've kept up my contacts with the media people. I can go on the tube, and make G.B.I. look a hell of a lot worse than they look already."

"What a nice individual you've become, Mr. McAilsh."

"I have rather, haven't I? I tell you what, you can put that Haw, Haw, Haw fellow's name—what is it?—Noonan, on the patent as co-inventor. That should clinch it."

I didn't know where to go from there. If there was any more to be got out of McAilsh, I felt, police interrogators could do a better job than I. I directed a few words up at the TV camera to terminate the interview. Lieutenant Smythe came by to get me. There was to be no further police interrogation. Kyle said: "Ye ha'e na' brought me an escort, lieutenant. Does that mean I can go now?" The lieutenant said: "Yes." Kyle said: "Thankye for giving me neutral ground where I could speak comfortable-like to my friend."

I felt used.

From my hotel room, I called Noonan. I had him convene Tommy Smith and a couple of PR people, to make a conference call of it. When they were ready, I gave them the downside. "G.B.I.'s legal liability is inescapable. I don't suppose the two people killed will give us much trouble. They don't seem to have any relatives or connections. Probably a decent funeral for

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them is enough to get us off the hook. We'll get a rap on the knuckles from OSHA, but that won't amount to much. The sea gulls are another matter. You know how difficult environmentalists can be when they can get to sue somebody like G.B.I., with deep pockets."

"Damn nature freaks," Noonan said.

"Now the upside. I've talked to Kyle McAilsh—"

"You have?" Noonan again. "Can we pin it on him?"

"Unlikely."

"Why not?"

"He doesn't seem to be guilty of anything."

"Damn."

One of the P.R. men came on. "The important thing is to minimize the adverse publicity."

"Kyle produced a plan that may let us do just that."

"He did?" Noonan. "Wally, you sound as if you favor the son of a bitch. I thought you hated his guts."

"He's changed."

"What's his plan?" Tommy Smith, cool, avuncular.

"It's this. One, we give him his old job back, with enough funds for him to develop that process of his he wanted patented. Two, we tell the world what an altruistic corporation we are—we're developing at great expense a process to elimate forever the old hazards and environmental problems. Three, we put half a mil into a Whoozie and Mary Virgin Memorial Fund for the relief of the homeless." Naturally, I didn't tell them items two and three were my idea, not McAilsh's.

Those at the Connecticut end of the telephone line made a great deal of noise. If what they had to say had been transcribed, the transcription would have been full of "expletive deleted"s.

Eventually, Tommy Smith calmed them down. ("That's enough, Mr. Noonan. I won't have my good man, Wally Mason, described as a stupid bastard.") Then, to me: "Wally, you'd better get this all down in writing. Fax it to us. You can go into a bit more detail, too, on what you see as our legal liabilities. Check back with Montague, see if you can help him any. Then get your ass on a plane and get back here as quick as you can."

There's not much more to say. When I got back home, grouchy from missing most of my vacation treat, the PR men had decided the McAilsh plan would help even if his process, ultimately, failed. Would buy time. They thought they'd decided we should accept it, but really it was Noonan who did, after I'd told him privately Kyle wanted him on the patent as a co-inventor.

Kyle was rehired. His old enemies have not resurfaced to hinder his work. He's grown a beard, perhaps they can't recognize him now. With adequate funding (and himself free of his granddaddy's influence) his condensation plating process has been reduced to practice, and has already entered production at Montague. When the patent was issued, I sent a copy each to my network of experts. I'd like to have mentioned it took the IRS, the exorcism of a dead granddaddy, a hurricane, and a couple of human sacrifices to bring it to a filable status, but I hardly thought they'd think that was relevant.

Besides the main patent, I was able

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to process several subordinate ones, preheating substrates to ensure good adhesion of the plating, close control of exposure time to the metallic gas to prevent melting from excess latent heat, ionization of the metal gas to enable it to be contained in a magnetic or electric field, and so forth. I've seen enough of McAilsh to get to like the fellow, though I do sometimes think he's reverted to the stereotype of an engineer. Noonan's name, by the way, is not on the subordinate patents.

There was one more tragedy. Wilkes Montague, his heart unable to stand the strain of the initial adverse publicity (which we could not avoid), finally died, and was replaced. By a Noonan protégé.

Now for the best part. Our cost accountants say the new process is cheaper than electroplating. Uses less energy. Less labor involved. Less materials cost. Less loss of precious metals in the plating washwater. There'll be big bucks for G.B.I. But more than that, they reckon, to maximize our income from process licensing, and to drive out the old technology, some of the gains—a bit over fifty million dollars worth—have to be passed on to the public. Which means, on a per capita basis, the McAilsh invention will save you money. Twenty or thirty cents a year. Don't turn up your nose at it. It's the savings you get from thousands of inventions like this one that keeps you as rich as you are. ■

Classifieds Continued

(continued from page 191)

weed! Entertainment nightly. Rent breathing equipment and accompany our experienced guides onto dry land itself! Special accommodations for air-breathers. Box -200.

READY to leave this Universe? We are specialists in the universes of Blimm and Plipp, two and five vibratory levels removed from this one. Generous time payments. (Cholera and *brymf* innoculations required.) Write to Universes R Us today! Box 00.

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HARD-WORKING *schlmenditt* needed for *klarshinning* and *borgging*. Pay negotiable, references a must. If you can't *brashhk*, don't apply. Box 559.

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SITUATIONS WANTED:

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NEED a planet terraformed? A solar system created? A religion imposed on those ugly little mollusks that will someday crawl ashore and inherit your world? Then contact D.E.I.T.Y. Corp., and together we'll whip your planet(s) into shape. Box YHWH.

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Jay Kay Klein's biolog

●"Connecticut Yankee" used to mean something special—an archetypally practical American, educated, and with a flair for invention and mechanics. *Analog* writer Daniel Hatch was born in East Hartford and, aside from military service, lived all his life in the state. Just about now, he's probably moved to Harrisburg and a new job. He'll find the natives speaking a slightly different brand of American English, more like that of Philadelphia. The great arbiter of American spelling and diction, Noah Webster, was a native of Hartford, and arranged his diacritical marks to reflect his own speech that has been accordingly accepted as the American standard for nearly two centuries.

Starting out in the engineering footsteps of Mark Twain's Connecticut Yankee, Dan spent a year at Worcester Polytechnic Institute. The Vietnam shootout was at full blast then, and the dean thought Dan ought to join the army and get shot. More practical, Dan elected the Coast Guard, where two years on the cutter *Gallatin* took him out of its New York City homebase to Europe, Canada, the Caribbean, and Hoboken, NJ. Another 18 months was spent at a helicopter station in Cape May, NJ, where he rose to Yeoman Third Class and did the same sort of work that Radar did in "M*A*S*H."

Having started reading *Fun with Dick and Jane* before kindergarten, he destroyed the school system's carefully calculated plan on how to teach the average student to read. Dan's verbal skills developed disproportionately to, should we say, engineering skills. Military obligations discharged, he majored in journalism at the University of Connecticut. He spent more time working on the student newspaper than in class, and covered a presidential primary campaign from four states.

On graduation, he sat down to become a full-time writer. Deciding a couple of years later that it takes lots, lots longer to sell a book than to write it, he broke down and went to work as a reporter. So far, there have been four books that haven't sold, though parts of one have been appearing in *Analog*. His first appearance here was in the May, 1990 issue. Like most determined writers, he turns out a preset amount of fiction every day. This precludes continuing serious amateur astronomy. His knowledge of this subject shows up in his fiction and, like his early flirtation with engineering, provides the type of background that finds a home in *Analog*.

Reading science fiction started in the fourth grade, and he's been a fan since high school, attending SF cons for over 20 years. Deciding to become an SF writer when he was 12, he had no idea it would take 26 years of education, learning about people, seeing places, and lots of practice writing before he would make a first sale. The type of hard science fiction that *Analog* is famous for interests Dan the most. He first makes up a world, or even a universe, based on research and calculations. The stories then start suggesting themselves.

Playing spacemen and aliens with blasters and computers can be fun, but Dan thinks that science fiction at its best shows man's reason and knowledge overcoming the moral problems that he has created. Other types of fiction can point out the problems, but they seldom include any practical solutions. Dan is a Connecticut Yankee interested in blueprinting new thoughts and ways of proceeding for the future. ■

Daniel Hatch

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ODE TO JOY

Dean McLaughlin

Vincent Di Fate

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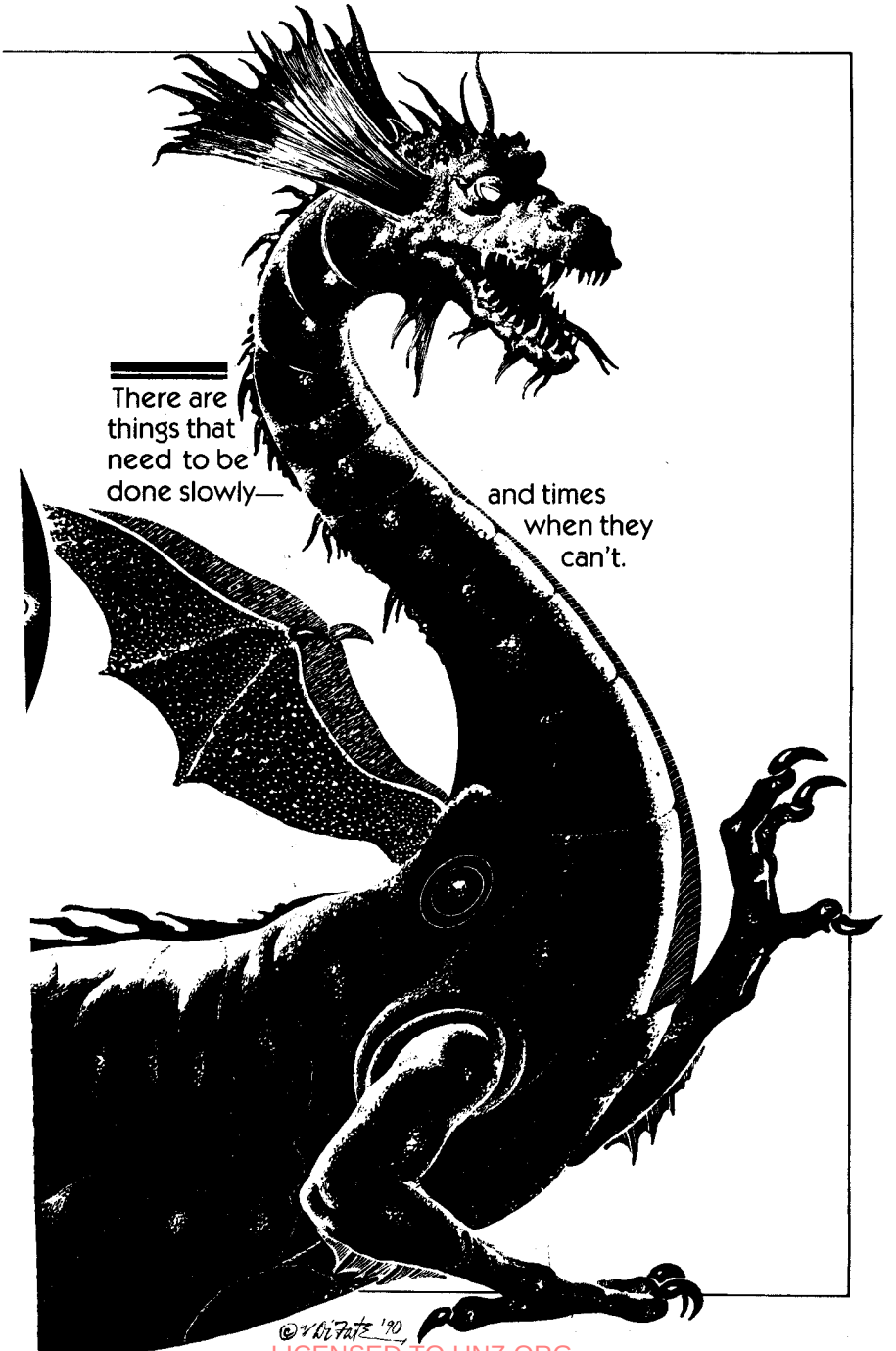

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Let me tell you about Hal Kenney.

Except that he's not tall enough, he's built like a basketball player. Lean, decently muscled, good with his hands, quiet. Behind those eyes—he wears glasses, by the way—you never know what's happening. He could think daylight in the dark, one of his professors said when I was checking him out. I wasn't sure what he meant: now, possibly, I do.

He made it through MIT on grilled cheese sandwiches; not a penny to spare when he came to us. His glasses looked like welfare specials and his jeans had seen too many stables mucked out, more calf ropings lost than won. His T-shirts —he seemed to have an infinite supply—featured such arcana as Feynman diagrams, S. Harris Cartoons, or an Escheresque drawing which, by optical tricks, makes visual the duality of particle and wave. Hardly, one would think, a young knight come to slay the local dragon, but the tools of that trade are no longer lance and sword. More sophisticated skills are required.

Hal didn't call attention to himself. He'd poke round his work space and after a while he'd have something to show. Our X-ray mirror was largely his work, and so was the whole-body chemical assay scan. Were I asked to say one thing about him, one thing only, I would say he thought long thoughts. That's something either you understand or you don't, like daylight in the dark.

I hired him because nobody—and I repeat, nobody—comes out of MIT with a doctorate at twenty-four *and* has a dissertation on the rest mass of the Tachyon where he's proved—experimentally, mind you, none of this theory nonsense—the tachyon has a rest mass *if*, and only if, there is such a thing as a tachyon. I was wanting a wild card sort of boy just then, and when that left-footed resume came to my desk I took one look, rolled mental dice, and phoned B.J. "He'll fly like an eagle or go down like the great auk," I told him.

"Six months," B.J. said.

"A year, with options and incentives," I said. I had a feeling, and long thoughts take time to blossom.

Maybe I should explain. We're a medical equipment company, fairly big but far short of the biggest. B.J. has this queer idea that Bell Labs was Ma Bell's greatest invention. No matter what, one percent of the company's sales goes into R&D, regardless how the bean counters scream. Take something out, you put something in. This gives me something like six or eight million a quarter to play with, a portion of which I'm expected to squander on blue sky. If I know how it's going to pay off, I have not done my job. With a boy like Hal Kenney, how could I lose?

We do, of course, keep in mind that the workers like paychecks and the shareholders expect their bread upon the waters to come back as something more digestible than negative numbers. When one of my people delivers a wiggle or widget, the question becomes, "What can it do?"

The answer would sometimes surprise you. Miglio's fiddling with disabled DNA strands is where our adjustable chromatographic filters came from, and the same work resulted in the fine-pore monomolecular stretch fabric

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that turned the beachwear industry sideways a few years ago. That wasn't medical, of course, so we licensed it to people in that market. Looked nice on the balance sheet, though. Still does, every quarter.

I digress. The other thing my department does, we keep a book full of unmet needs. Our wish book, I call it. Packing material for wounds that will facilitate healing. An artificial cord that will splice a cut nerve. An implantable kidney replacement. That sort of thing. When things get dull, by which I mean nothing has happened for two or three weeks, I pick a random few and, where they fit, drop them into conversations. Once in a while something clicks.

The day Hal arrived I gave him a copy. He flipped through, and we talked for an hour or so while I showed him around. One thing I mentioned—I'm sure it was then—was radioactive waste. Clinics and hospitals churn out preposterous mountains of it, and to handle it safely is expensive, troublesome, and probably not possible. Like garlic, I said. Once you have it, it stays to contaminate all it touches.

Hal grinned a wry grin. "Chicken heart," he said.

I must have blinked. Hal's grin turned sheepish and he tapped himself above the ear. "Blip from the noise level. All the not-real things you scare kids with. One of those. Like dragons."

I hadn't the slightest idea what he was talking about, and conversationally I spun my wheels to get back on track. The problem was real, I told him. Unchecked, the world could be made unlivable. Thousands had spent whole lives on the problem. Hundreds of ideas had been tried; score to date: lions three, Christians nothing.

"Uh huh," he said, and stuck to his metaphor. "Seen any dragons lately? Only got to kill 'em once."

Well, that was what I wanted him for: to think things I could not. Having planted the seed, my part was done. I showed him his work space and left him to find his own way.

Must have been six or seven months later the phone call came. I could look up the date if you want. There'd been an accident in Building Twelve. Some time midmorning I'd heard sirens off that way but hadn't really thought. Not my department and, usually, in spite of alarums and excursions, such affairs turn out insignificant. Not this time, O'Donoghue said. A radiation thing, he explained, fairly bad, and they were humbled to admit it was more than they knew how to handle.

"The cleanup squad's doing fine," he said. "It's the girl got me worried. Mort Drucker says one of your gnomes has a thing that might help."

Possibly five weeks before, wearing the silly little film badge he'd insisted I wear—he had one himself, of course—I'd sat on one of those monkey-perch stools down in the shop and watched while Hal tweezered a sand grain of bismuth to a geiger which squealed as if its tail was caught in a door, then mounted it inside a ceramic containment with a quartz lens pinhole. He pumped the air out and clamped the vessel tight in the center of a complex arrangement of electromagnets. Then he and one of our shop men—Terry, I think—wrestled the lead shield into place and made sure the mirrors were rigged to give us a

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view. He sealed the isolation chamber and made sure the air vents were shut and air pressure stepped down inside. Careful. He checked one more time that all the wires were connected to the pulse generator and that no bare wires touched each another. I've watched surgeons work, and his hands were just as precise.

Finally he came back, made sure Terry was clear, gave a glance my way—I nodded—and pushed the button.

I'm told that every phone and alarm system within a hundred meters went nuts. All I remember is the bright blue flash we saw through the containment's quartz lens and the tiny ping as if a small wrench had been dropped. Testing with the geiger every step, Hal went back in. Not a whicker. When he touched the containment, all of a sudden he jerked his hand back and for a moment I thought he was going to lick his fingertips. Instead he blew on them. "Hot," he explained. Then, sheepishly, "I mean it's . . . uh, very warm." He had to use the geiger to make himself clear.

Donning a glove, he brought the containment back to me. I could feel the heat myself without actually touching. Also, it had cracked, but that was all right. The geiger stayed quiet and its LED's reported zero and zero and background only. Inside, when Hal got it open again, the bismuth was gone; our metallurgist, Barnhart, later found the interior thinly plated with a lead and bismuth alloy. Stable isotopes, every last atom.

"It shouldn't have cracked," Hal said, as if because of that the experiment had failed.

I wasn't bothered. "Hal," I said, "we can do things with this. Three or four things." Actually I'd lost count. Feeling pretty good, all sorts of possibilities filling my thoughts, I went back upstairs. Phones were working by then. I had Marta put through a call to Hamilton Hammond, our patents specialist. We had work for him.

So when Elton O'Donoghue called five weeks later, I knew what he hoped. Remembering how hot that containment had been, I doubted it. All I said, though, was, "I'll talk to him. I . . . well, I'll see what he says."

I went down the corridor to Hal's work space and explained the problem. Hal listened with his head down, not looking at me, perhaps not looking at anything. He had a rough sketch of something in front of him and I wondered if his thoughts were of that instead of what I was saying. That was Hal: gather all the information, then see how it fits. *If* it fits.

When I finished he just shook his head. "No good for that. What's being processed has to be inside the field and . . ." He nodded at the pilot model, there at the back of his workbench where he could tinker if he had a mind. ". . . there's no room for a person. And the way it works, it accelerates the natural decay process, so the unstable nuclei go through their whole cascade of disintegrations in, oh, a microsecond or so. All we'd do would be to give her the whole radiation dose in one shot instead of spread out in time. And the heat energy . . . if she's been exposed that bad, she'd . . . well, she'd be cremated."

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Then he looked at me. "Building Twelve? Did he say who?"

O'Donoghue hadn't mentioned a name. I told him that. He said, "Find out, could you?"

I said I would. Back in my office I called O'Donogue with my negative report. "Can you tell me who it is?" I asked.

"Well, it's not for circulation," he said. "Still looking for the family. But it's . . ." He slowed down and let me listen to papers being pawed. "Here we are; name of Errin Hobart. Somebody you know?"

I repeated the name to be sure I got it right, not noticing Hal in the doorway until I'd said it. I thanked O'Donoghue and hung up; by then Hal was moving toward a chair. He looked like someone had hit farther down than the Queensbury rules permit. "Is she gone to the hospital?" he asked.

O'Donoghue hadn't said. "I imagine so," I said. Then I remembered the mention of tracking her family. "You know her?"

"Took her out a few times," he mumbled. "Mr. Norway, look, I don't feel very good. Would you mind if I go home?"

In this department we don't punch a time clock, and one glance told me he'd get nothing done the rest of the day. I let him go.

Much later I learned what had happened. Building Twelve is a production facility, and that morning they'd been scheduled to load cesium 137 into a run of radiation treatment machines. How they do it, the cesium comes to the handling equipment in a heavy lead canister. After the canister has been airlocked into the helium atmosphere chamber, the handler—by remote control, of course—opens the canister, breaks the glass capsule inside, and weighs the material directly into the shielded treatment machine housings, commonly called bombs. I do wish we had some other word. Once the bombs have been sealed and their apertures capped, they're safe to be handled. In theory it's a procedure free of risk. No person comes in contact with the cesium at any time, which is good because radioactive cesium is nasty stuff.

A few rules got broken that morning. The transport canister should have had its top bolted down, but it made the job simpler to leave the bolts off. The dolly used to move the canister was not the one that should have been used. This one had a high center of gravity, and with the canister aboard—off center, by the way—it was awkwardly top heavy. No one thought about that. And while the rules say two men should be handling the dolly, only one was actually holding on. The other merely walked beside it.

Also, other things were done wrong. The helium chamber stands a story and a half high, and the air lock where the canister enters is reached from a catwalk above Building Twelve's main floor. So the dolly was being trundled along the catwalk to the airlock when one of its wheels got caught in one of the catwalk's floor panels that had a cracked corner. Well, the dolly tipped over, the canister's top came off, and the capsule popped out.

Now, as I've said, the capsule was glass. Fairly strong glass, but still egg-

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shell thin. Both the canister top and the capsule were thrown through the catwalk's openwork railing. Errin Hobart had the misfortune to be standing directly below, leaning against a ceiling support with a clipboard in her hands, monitoring a machine that had nothing to do with all this other business. The canister lid bruised her right arm, taking skin off from shoulder to elbow. The capsule struck the ceiling support about two feet above her head and shattered, showering broken glass and cesium powder down on her. Surprised, she opened her mouth to scream, inhaling no one knew how much. Got it into her eyes, hair, nasal passages, ears, mouth, throat, stomach, and lungs. All over her clothes, too.

After roughly five astonished seconds, somebody yelled, "Spill!" Somebody else remembered to hit the klaxon, and the cleanup squad, which doubles as fire and emergency crew, came running. Give the girl credit: she should have been wearing a safety hat, except she hadn't been told she was in a hazardous location. Otherwise, she did things right. Sneezing and choking, she stayed where she was until the cleanup people arrived and got a breathing mask on her, vacuumed her, wrapped her in plastic, and hustled her off to the decontamination room. She spread the spill no farther than it had gone. I believe even then she knew she'd been killed.

Hal didn't come in the next morning. He phoned; still feeling unwell. I didn't press him. "Have you heard any more about Errin?" he asked. "The hospital won't tell me anything."

Right then I knew nothing myself. I told him I'd inquire. "I'm sure they're doing the best they can," I said.

"How good is that?" he asked.

That was something far outside my powers. "I really have no idea," I said. I know that sounded lame, but to him it was desperately important. In such circumstances I will not lie.

When he called twenty minutes later I'd talked with O'Donoghue. The hospital people were doing everything they could, of course, but it wasn't a day for miracles. On the outside they'd scrubbed her just about raw except for the skinned arm, where they had to be more gentle. Repeated washings had helped there. Inside, they'd flushed out her stomach, getting much but not all. Some had gotten into her bloodstream. Her lungs, well, they had to be careful not to exacerbate the damage. Irrigation with fluorocarbons had taken out some, but they wouldn't say how much had bonded chemically, how much was lodged too tight to move. On the positive side, they'd taken a healthy sample of bone marrow—and by healthy I mean both condition and quantity—froze a portion and were culturing the rest, so even if all her marrow was destroyed, if they got the cesium out, they could implant the cultured marrow and she would be able to make her own blood again. Meanwhile, a specialist was flying from Seattle. Promises, however, they would not make. Hal noticed the omission as quickly as I.

"She's not going to make it," he said.

I said the only honest thing. "I don't know."

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"Well, thanks," he said, and dropped off the line.

He'd met her in the cafeteria. She'd been with some friends but when they got to a table there wasn't room. Hal was at a nearby table with a sandwich he'd brown-bagged and a cup of coffee. Beside him was an empty chair. "Mind?" she asked.

"All right," he mumbled without looking up. He had his portable in front of him. He punched a few numbers and scribbled in his notebook and took another bite from his sandwich. After a while he punched a few more.

She'd taken a minor in math at MSU so it wasn't completely foreign to her. Nevertheless it was still high stratosphere. She asked a question that was a lot more intelligent than he'd have expected from someone small and blonde. He mumbled a casual answer, and before he could bite his sandwich again she asked another. Next thing you know, he'd pushed his notebook aside and they were talking. After that, well, I could show you the blueprints, but I think you know what was happening.

The following day I went home for lunch. Some interesting mail awaited, so I was later than normal getting back. As I do when I've been out, I paused at Marta's desk to check if anything needed prompt attention. She told me Hal had appeared, had used the computer a few minutes, then gone again taking several reference books including our freshly arrived new edition of *The Handbook of Chemistry and Physics*. Miglio had found it gone and was upset.

"It's that girl," she said.

That was no surprise to me. "It seems he knows her." I explained how he'd reacted when he learned it was she. "I hope he's not deluded to think he can do something."

"I'm sure he does," Marta said in a tone that made it clear she shared my worry. "But it's got a complication. Did you know they broke up?"

That did startle me.

"I don't remember what I said," she went on, "but he went all tight. And what he said, near as I remember: 'If I was crossing the street, she might take her foot off the gas.' He's . . . he's terribly bitter."

Among her skills, Marta is good at wrapping her tongue around an inflection. I frowned, trying to make this piece of information fit with everything else. "We may have a problem," I said.

She's good at catching my thoughts, too. "I hope he doesn't think he can get her back that way," she said. "That's an ugly trap. For both of them."

Indeed it was. My own thinking hadn't gone that far. I stood there with the few grey cells I have left blundering around. Her condition seemed hopeless, I thought, so the other problem would never come up; having seen what Hal was capable of, though, I was less sure. "Marta," I said, trying clumsily to make light of things, "don't you wish sometimes it was like in the old days, when your father would sell you for a dozen sheep and three cows?"

"Cattle," she humphed. "Simpler for whom?"

Hal came back for about an hour that afternoon. I left him alone. He hadn't shaved and the socks showing out of his

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K-Mart running shoes were black and grey, one of each. I contrived to walk past his work space; he sat slouched in front of his computer terminal, a stack of equations and a graph confronting him. Later, when I walked by again, he was gone.

Just before I went home, he phoned to ask if we'd heard anything new. I'd talked to O'Donoghue minutes earlier; no news and no hope. I told Hal no news. He thanked me and hung up.

All I'd had from O'Donoghue was that the specialist had flown back to Seattle with a growl about wasted time. Oh, and her mother had been reached and would come when she could, a nuance that troubled me.

Close to midnight, Hal called me at home. By then I was worried as much about him as the girl. "Could I have Mark and Terry do some things tomorrow?" Mark Miller and Terry Upton were our two best machinists. "I know there's other jobs. It's important."

He'd never called me at home before. "Your new project?" I asked. I wanted time to think.

"Yes," he said, the word uncommonly crisp.

I considered what else my small principality was doing. "You think you have something?"

"I *know*." Intense before, now he burned. Drew Andrews would be unhappy but, well, nothing urgent there.

"You'll owe me," I warned.

"Got to have them," he said. "Please."

I dithered only a moment. "They're yours," I decided. I was slow getting to sleep, remembering how he'd said please.

I tried to arrive early, but that morning he was first. Mark and Terry hadn't shown yet, and he was fretting around. I don't think he'd slept much. A half-ream of paper flopped loose in his hands. He paced the corridor and peered from the reception room's window at the parking lot. "What are you trying to do?" I asked.

He went to the window again; still nobody coming. "I think we can reverse it," he said, turning, and when he saw my puzzlement, "I mean, the disequilibrium enhancement process is just a straightforward chaotization of the forces that make disequilibrious nuclei decay, which are really just aspects of the ordinary exclusionary/attractive force we're all familiar with. Like, well, magnetic polarities or the similar and unlike electrical charges. Only there it's expressed as the weak force and the strong force. That's what radioactivity is. It's a misleading term."

Agitated though he was, he must have seen my eyes turn to solid glass. He hurried on. "Anyway, what's actually happening—what I think's happening—when a nucleus decays, it's the last stage of a long series of interactions inside the nucleus. Between the particles present, that is, only they're not really particles the way we think of particles on the macroscopic level. And what happens is governed by the relative strengths of the weak force and the strong force, which are what dominate at the nuclear level, plus the electromagnetic force of the orbital electrons. I explained that, didn't I?"

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He may have once, though how much I grasped was doubtful. My part of the business was results, not how to get there. "Now, what I was doing was reconfiguring the nuclei so the strong force would have more effect than the weak force, so a nucleus that was predisposed to decay would decay right then. That's easy and it doesn't take much energy, like—well—knocking down something that's ready to fall before you touch it. So instead of some of the nuclei in a sample expelling a discordant particle now and others waiting till next week, and so forth, they'd all do it now. This business about half-lives, that's just a statistical way of treating large numbers of specific cases. It doesn't describe what's happening to the individual atoms. Got that?"

Perhaps 10 percent of that I got. I know my limitations, and that is a statistical way my brain has of handling more information than it has room for.

"So what we need to do," he went on, "is reconfigure the nuclei so that the weak force is dominant, so the nuclei will hold together longer. Lots longer. That's not so easy to do. It's not just a matter of inverting a polarity. It's taking a chaotic system—a semi-random assortment of chaotic systems—and . . . and jiggling them so they become more stable instead of less."

I had rarely seen him so worked up. "Remember the Columbus trick? Standing an egg up on end? It's sort of like that, only here we've got a gigazillion individual nuclei, active ones, mixed in with a lot of others we don't want to touch, and we've got to do it with every last one. I . . . I think there's a way."

As if out of breath, he fell quiet then. When he resumed it was of something more practical.

"We may need lots of power," he said. "I'm not sure. What's our line capacity here? And circuit breakers. We'll get surges, big ones, so we may have to bypass the breakers. Maybe we'll have to isolate our system or we'd black out the whole power grid. Can you handle that?"

One thing the management gurus tell you: when you have a motivated work force, stand aside. "Let's see if I have this right," I said. "You think you have a process to make radioactive materials stable. Correct?"

"I've got to," he said. "Got to." Then he saw Terry in the parking lot, and Mark close behind. He vanished down the stairs. I went into my office and began a long list of phone calls which took all morning except for an excursion down the corridor for a word with Gordon, Gordon Foulkes. After which he obliged me to sit through a videotaped fiber-optic adventure through a rat's alimentary canal from—shall we say?—the reverse direction, with side trips into the caecum and the bile duct; and afterwards proudly showed me the selfsame rat's gut dissected out, opened, and laid flat.

"Not a single lesion from the procedure, you'll notice."

I would not have recognized a lesion had we been formally introduced, and I detest the stink of formaldehyde. "What about the circulatory system?" I asked. If this fine cable system could explore a rat's blood vessels as routinely as our larger systems explore a human's, obtaining useful information without in-

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terference with blood flow or physical damage, every rat lab in the country would want one.

"I should try it on the respiratory tract next," Gordon said, "and then the genito-urinary. That will require a slimmer bundle of fibers, I expect, as would the circulatory system, with perhaps a consequent loss of detail; and of course the latter would require an incision of great delicacy."

I nodded absently. At times, Gordon can be tiresome.

"And I shall have to conduct the present activity on at least another twenty-five or so," he said, "and perhaps twenty-five with esophageal entry. One swallow doth not a summer."

Aye, I thought, containing my gorge at what might have been an inadvertent pun. And amen.

Some time midafternoon, Hal put his head in my doorway. "Can we have them stay overtime?" he asked.

For a moment, I didn't know who he meant. "Mark and Terry?" I bumbled.

He nodded. I thought for about ten seconds. Our shop men were Other Ranks—skilled craftsmen from the general work force and subject to all the tiresome time clock rules. Did Hal understand? He'd neither slept nor shaved. Fermat's Theorem on his T-shirt was smudged. "How much overtime?" I asked.

"Don't know. Till it's done, I guess." Then, "They're willing."

"You asked? Specifically?"

He nodded, anxiously mute, and I couldn't turn him down. Not then. I gave him an upward thumb and pasted on my sunniest smile. Breathing again, he started to go, but came back. "Anything new from the hospital?"

He'd already asked three times that day. There wasn't. Her mother was on the way and expected to be met at the airport; that was all. I shook my head.

Later he was back. "Does cleanup have some of that spill yet? Could we have some? We'll need it for tests."

I thought of the paperwork needed for nuclear waste, sighed inwardly, and picked up the phone. Somewhere, I think, we'd forgot who was working for whom.

The hazardous waste department sent a man with a lead-lined plastic box on a hand truck. When I'd signed, he handed me a pair of gloves thick as a catcher's mitts. "Call us when you're through," he said. "Don't leave it loose. And careful what you do. Worst mess since I took this job."

He was thin and grey, both skin and hair, and glum of face. I judged him fiftyish, stooging toward retirement. "Oh. You'll need these." He spilled a handful of film badges on my desk. "Make sure they write their names on."

"I hope we won't need them," I said, without much conviction. With a sour curl of his lip, he tromped away.

Hal was down in the shop. He was on his knees with a welding torch putting adjustment brackets to the corners of a triangular frame which had been rather crudely fixed outside the doughnut hole orifice at the end of a large cylindrical housing which, just then, I could not place. It looked familiar. Both frame and brackets were solid brass, so with my usual grasp of the obvious I concluded the project must involve strong magnets. Tempted, I recalled my

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last request for explanation and chose to stay quiet.

"I have the material from the spill," I said. "Where. . . ?"

"Bring it down?" he asked. "We're not ready yet. Did they think to send an assortment? I forgot to ask." He went on welding while he talked, so I couldn't look at him if I valued my retinas. Also, he was wearing a mask.

I had not looked inside, I explained; knowing its deadlines, I felt no wish to do so. I also mentioned the film badges. Without a pause, he clamped another bracket into place. "Yeah. Guess we got to," he said, and fired up his torch again.

For dinner I went home, but afterwards I told Jennie I was going back. "It's about that girl, isn't it?" she said. I'd had to tell her something after Hal's call the night before. I nodded.

"How late?" she asked.

All I could do was shrug. "Don't wait up."

"Bring us a winner." She gave me a warm smile.

At the plant I didn't so much as pretend I was headed upstairs. I looked into the shop. Yes, progress.

Seen without the distraction of a welding torch, I recognized the big cylindrical thing as having been—before Mark and Terry went to work—the hardware part of a magnetic resonance imaging machine, one of several obsolete units we'd taken as trade-ins against new equipment. Most had been disposed of overseas, but this one, needing refurbishment, had been mothballed in the warehouse. As I had not requisitioned it, nor been asked to, I was appalled to see what they were doing.

The microwave components had been gutted out and junked in several cardboard boxes which still sat where they'd been shoved, far enough to be out of the way but possible to be tripped on. Into the space thus vacated, Mark and Terry were fitting a tube of terra cotta drainage pipe segments, placing it in line with the lower left apex of the triangular frames Hal had welded to each end of the housing. Duct tape would hold it in place, and they were trying to leave clearance for the Teflon examination table to roll in and out, a consideration which called for careful chipping where two segments joined.

Were that not enough, I noticed the MRI's helium tank had been brought in and hooked up—several days ago, in fact, as the reliquefying equipment was functioning at steady state. That meant the superconducting coils were cold, ready to be used.

Hal, meanwhile, was up on a scaffold, carefully pouring melted copper into an upended, very long length of seamless brass pipe.

All of that I saw more quickly than it takes to explain. It bothered me. Liquid helium is not inexpensive and, like the MRI unit, I had seen no paperwork on it. Nor, for that matter, the drainage pipe. That I had not been told everything was obvious. Equally obvious, though, it was not the time to assert myself. Motivated personnel and all that.

To this day I'm sure none of them saw me. I tiptoed back from the doorway and up to my office.

By nine o'clock I had moved across my desk every dull piece of paper from

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the past month. I had also drafted requisitions to cover the items I'd seen, leaving blank for the moment details not at my fingertips. I was debating—dared I take another look?—when B.J. phoned.

"What's going on over there?"

"Working late," I said. Calmly I hoped. "Should we be different?" Through my window I had noticed lights in one of the windows of the front building. Not hard to guess whose. "Special project. One of my people has an idea."

"One of your people used a lot of computer time last night. You know that?"

I hadn't, but it figured. "He's authorized." Out on a limb and the limb bending under my weight, I had to hang on.

B.J. breathed on the phone long enough to worry me. I decided he'd better know the whole of it. "It's about that accident in Building Twelve."

He listened. He listened for a long while, and as I talked I kept thinking of things. I scribbled notes on my blotter. "I don't know how far it's going to get," I told him. "Just to be safe, maybe we'd better let Hayes, Hayes and etcetera," that's the company's law firm, "know about it. And the hospital. If we get that far when we're ready to move, it'll help if they're prepared."

"Sort of late, ain't it?"

My clock said 9:20. "No one's in bed yet. Oh, and what about the insurance company? Shouldn't they know?"

I will not, in mixed company, repeat what B.J. said about the insurance company. Then he said, "Carla's still here." Carla Gilliland is his secretary. "We'll take care of all that."

* * *

I went downstairs. Now they had terra cotta tubes emplaced between each pair of triangle apices and Mark was testing the Teflon table's freedom of movement for the first or dozenth time. As for Terry, he was helping Hal weld huge electrical connectors to the ends of three long brass pipes; presumably the same pipes I'd seen Hal filling with copper. That reminded me of something he'd said about power demand, a subject of which I know little, and wondered if B.J. would mind being asked, in addition to his other calls, to follow up the one I'd made to Gas & Light that morning. The size of those connectors had me worried. I had not thought, then, how fast and far the ripples were going from my small part of the pond.

I did think of one other thing. I got Mark aside. "You came at eight this morning," I said. "Time you checked out."

"Don't mind stayin'," he said.

"The rules say twelve hours is top," I reminded him. I felt wrong saying it, regardless that it was true; I had no choice.

Mark backed up and looked down. Broad as an oak, long of face, somewhere fortyish; his thick hands had the thin dark lines of grease embedded between the ridges that said he'd spent his life with machines. I felt like an insect.

"Meaning no disrespect, Mr. Norway," he said. "If you want it that way, I'll go to the time shack and punch out. But then I'll come back. All right?"

"That's another rule," I said. "Workers off duty off the premises."

Head tilted slightly to one side, he seemed to gain height. "Now Mr. Norway, you wouldn't do that to me, would

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you?'' He spoke quietly, the way big men sometimes do.

''Well, I . . .'' The trouble was, I truly wouldn't.

''Look,'' he said. ''The wife knows the family, sort of. And, well, that kid needs something good to happen for a change. First her folks got divorced—the kind with a lot of hate in it. You know how that does. She was like thirteen then. Not a year later, there's a car jumped a curb, knocks her down, like to kill her. Broke her arm, couple ribs, a cracked head. Well, she got over all that, and then a dog bites her, real deep. It got infected and they had to dig a hole in her leg, and they never did find the dog so she has to take the rabies shots. You know what that's like?''

Being in a business related to medicine, I knew enough to wince. Ordeal is one of the milder words. There ought to be a better way, and yes, it's in our wish book.

Mark wasn't done. ''All right. So she starts college, and what does her ma do but pick up and leave for some place, Arizona. And right after that she has a boyfriend killed some freak crazy way. Broke his neck lugging a canoe, I think they said. Other guy tripped. Now, the question is, does Mark Miller say this ain't my problem?''

What could I say? Logically, it was not. Logically also, I would be damned forever if I told him so.

After a moment, Mark had one more thing to say. ''I'll sign any paper you want, Mr. Norway. I don't know how much chance she's got. Maybe she'll make it, maybe she won't. I'm not in charge of that department. But if she don't, it's not 'cause Mark Miller punched out and went home.''

Terry was standing behind me. I hadn't noticed. ''Me either,'' he said. ''Old lady'd never let me through the door again.''

I felt outnumbered, outclassed, mutined against, and properly shamed. ''Did you get any dinner? Either of you?'' I asked.

''Got a sandwich 'fore the cafeteria closed,'' Terry shrugged.

The cafeteria shuts down at two, right after lunch. I went upstairs to Marta's desk and phoned for pizzas and stoked up our coffee machine. When I could get through, I talked to B.J. about the power company; I expected him to go into a war dance, but all he said was, ''You believe in this guy?''

That made me back off and think. All those fantasies of knights and dragons and ladies fair tempted greatly; it would be so fine. Heartlessly, realism cast them not on the seacoast of Bohemia, but on our own world's stony shore. ''I would like to,'' I said, walking the fence as it were. ''He's on overdrive, and maybe 180 degrees wrongheaded. But we ride with him, or we'll never know what we slammed the door on. Has she any other chance?''

''They tell me they're trying,'' B.J. said. ''They're not keen on untested treatments, either. You know what that's like.''

Amen, do I ever. ''Did you ask?'' I asked.

''I've put 'em to the wall every time we talked,'' he said. ''After I get all the shrubbery off, what they say is they're waiting for the lights to go out. All right, Nevvie. The dice are loaded and the

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wheel is fixed, but it's the only game in town."

Win or lose, for that moment I would love him forever.

Back downstairs, I asked how I could help. Hal put me to work joining cables between those long pipes—which now were run through the drainage pipes—and a rather large pulse generator that sat like Buddha on a freight handler's wagon. Snaky and thick, the cables had a proclivity to form kinked loops like a garden hose. I skinned knuckles scratched thumbs, cracked fingernails, and acquired a blister or two. I took off my waistcoat and tie. My shirt, trousers, shoes, and hands, were quickly grungy. I have rarely felt better.

Each time I had a pipe connected, we tested. Not simply to know if we had a good circuit; Hal had taken a long foot-wide plank, fastened molding strips to the sides to make a shallow trough, then placed in the trough a length of green-band printout paper pulled tight from one end to the other. This he placed on the MRI's platform and, anointing it with a scatter of iron grains, rolled it into the machine's central cavity. When he closed the switch, it was as if a powerful wind had come up. Swirling like snowflakes, the filings arranged themselves into nearly perfect transverse lines.

"Just like in high school," he murmured the first time.

Only I heard. Mark and Terry were busy building a partition of steel plates halfway across the shop's width, closing off our area.

Our second test, with pipe number two, something was wrong. The electrical current went through, but when we brought the platform out the iron filings lay in a pattern that was clearly undesired; lines curved away from each other, densities irregular. Hal checked the connections but found nothing obviously wrong. "Voids in the tube," he muttered. He leaned against the housing, eyes shut, for what seemed a very long time.

How long since he'd slept? Placing a hand on his shoulder which I hoped he'd think fatherly, I gave him a cup of coffee and made him go outside where it was cool and he could breathe fresh air. When he came back Mark and Terry had removed the faulty pipe and were putting in one of the spares which, foresightedly, he'd made. "Sorry," he mumbled. "Just want to get this thing done."

It must have been 11:30 or so when Hal put down his wrench, and there was something final in its clank. To my eye there seemed nothing more to be done, but how could I know? He pushed an empty pizza carton out of the way and gulped a sip of coffee, either from his cup or mine; cold as death it must have been. "Now, see what we've got," he muttered.

Speaking to me? I still don't know.

The plank with its iron particles was inserted on the Teflon table again. He nodded Mark and Terry back behind the screen and followed himself, taking station at the pulse generator. He looked to be sure I wasn't somewhere dangerous, which I'd taken care not to be. Satisfied, he touched a button which as easily could have been someone's doorbell. Our lights dimmed momentarily, but then came up again. On the panel,

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status lights changed. On the other side of the screen, somewhere, electricity sizzled and a piece of metal clattered. Hal waited, but when nothing more happened he stepped over the power cables and approached the machine. He peered into the cavity. I had followed close behind.

This time the filings had arranged themselves into lines extending the length of the cavity. Hal studied them so long I wondered if he'd gone to sleep on his feet, but then he went back to the pulse generator and touched, I suppose, the same button as before. Though the filings barely stirred, they seemed to relax. Magnets off.

Returning to where I stood, Hal nodded Mark and Terry forward. "Bring it out. Careful you don't jiggle," he said.

So far as I could see, they did it perfectly.

"Now where are. . . ?" Hal began, looking back over his shoulder. "Oh. There."

What concerned him was a brown paper bag with a hardware store's logo. From it he took a can of spray paint, red if I recall, which he proceeded to spray onto the paper end to end, lightly, iron filings and all.

I must have had a strange look on my face, because when he set the can down he said, with a sheepish grin, "Quick and dirty test. At school they'd kill me for this." Then, "Minute to let it dry. Any more coffee?"

There was. And I started another pot.

By the time I got back downstairs, the paint had dried. Mark and Terry had the board up on end, banging it on the floor to shake the filings loose. "Don't worry about getting it all," Hal said. Much of the iron was indeed stuck fast, especially out near the sides.

I handed the coffee around. Hal tested his; too hot yet. He dug in the hardware bag, this time coming up with a pair of four inch brass nails. While I watched with my own cup in hand, he hammered them into the plank, one at each end, each driven through the paper where the filings had bunched most thickly. "More quick and dirty," he said. Mark, meanwhile, was sweeping loose filings up off the floor.

Next Hal gave the paper more iron and again rolled the platform inside. With the magnets back on, he sighted from one nail to the other and nudged the board side to side until he had almost the same alignment as before. Tired, edgy, I could see his patience wear thin, but he stuck. I was not happy with the look in his eyes.

"He'll hold as long as he got to." Mark said at my ear while Hal, kneeling, jiggled the board. "It breaks, and he's done."

I nodded. No help for it, there'd be a price. I didn't let myself dwell on that too much.

Hal stood up. Coming back to the pulse generator, he shut down the magnets. "Axial field," he mumbled. "Now the transverse." He peered around the screen, hesitated, then turned. "You do it," he said, gaze transfixing me, as if my hands might have a magic his lacked. Absurd, but dare I tell him that? I let him show me the buttons to push, the sequence to follow. Prosaically simple. Anyone could have done it.

He wanted to be up close, he said.

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He wanted to see how the iron grains shifted. As well to scry the flight of birds, I thought, or haruspet the liver of a sheep. I stayed silent. Skepticism now had no place. We took our stations.

"Phase one," Hal said.

The part of the panel that concerned me had two columns of buttons, of which only the top three pairs were operative. One column was simple on/off switches, one for each of the copper-filled pipes. The other column would reverse the flow of current, the relevant buttons being paired. Monitor lights, red and green and yellow, would help me keep track. Later, in operation, a sequenced program would do the work; for testing the alignments, something less quick was desired.

Phase one was the top button in the on/off column. "Done," I said. After a faltering hesitation our lights returned to full strength.

"Say, 'Current in circuit one,' " Hal called, not even coming to where we could see each other. "Got to have it exactly." Then, after a pause, "All right. Phase two."

That would be the second button of the on/off column. "Current in cir . . ."

I got no further. This time our lights did not merely stumble, but dimmed, surged feebly, and died. "No!" Hal yelled. In the dark . . . well, I'd feared this might happen, so I'd noted where the circuit breaking button was; fumbling, I took several seconds to find it, and possibly it took our power system equal time to decide it was safe to provide light again. Dazzled, we blinked at each other. Terry was first to find his voice. "Now what?"

That was when the workman with a Gas & Light patch on his coverall came through the loading dock door with a cable that looked, to half-blind eyes, like a fire hose. Under his plastic hat was an unshaved face that could have come out of He-Man Comix. "Hey, where you want this thing?"

None of us had tongues for a while. I think Hal turned his brow against the cinder block wall. "Over here," I managed finally, and virtually groveled to disconnect the power leads. Have I mentioned they'd been clean pants that morning? Never be the same again, I thought, but neither would I.

Five men comprised the Gas & Light crew. They required less than half an hour to connect their portable substation—"portable" meaning wheels and a trailer hitch—to a power main and hook the cable into Hal's system. They neither dawdled nor asked needless questions. I fed them coffee, it was all we had, and stoked up another potful. Also, while upstairs, I phoned for more pizzas. This night had a distance to go.

Our tests dragged on. While I did thumb-fingered service at the pulse generator, Hal watched the dance of the iron grains and called out the circuit changes. Several times he had me shut down completely and attacked the adjustment screws. I must admit I did not understand his goal, but clearly he was working toward it with exhaustive care.

Each time adjustments were made, we repeated the sequence of circuit combinations. Dull work, but necessary. Midway through, our second consignment of pizzas arrived, and it was only then I realized the men from Gas & Light were still with us. From their corner they watched, cups of coffee

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turning cold in their hands. Of course I invited them to partake.

My wallet, I found, was depleted, and the pizza driver hesitated, unsure, at the flash of my glittery plastic while the stack of boxes he'd brought disappeared as if locusts had swarmed. "A check?" I proposed.

"Here, Mr. Norway, I got it," Mark said, ramming a slice hot and gorgeous into his mouth while his other huge hand descended to a pocket. I spluttered something, to which he growled "Can't run on empty," and dodged my hand when I tried to take the receipt. "This ain't just you and me, Mr. Norway."

The driver had turned to go; I took a step and opened my mouth to suggest, perhaps, another trip if suitable credit arrangements could be made. Before I could speak, he stopped, turned, and asked to use our phone. Slow of thought —remember, it was past midnight now and much had happened—I conducted him to Marta's desk upstairs and forgot the matter.

Hal's adjustments continued. Now he was working with the power left on, peering into the cavity with a high power flashlight, and telling Terry to make quarter turns, one-eighth turns, and one-sixteenth turns with the screwdriver. It had an insulated handle, of course, but with all that bare, energized metal around I was terribly frightened. Well, of course it happened. Terry recoiled from a sizzling blaze of light that threw stark shadows into every corner. One of the Gas & Light men stepped out of their huddle, pizza drooping from his fingers. "Hold a minute."

He went outside, returning moments later with several pairs of scorched but impressively thick gloves and a handful of assorted size screwdrivers which, I gathered, were not so prone to pyrotechnic displays.

"Gotta go equipped," he said, and placed a yellow plastic hat on Terry's head. Hal he awarded one that was beach-ball red. "Amateurs give me the willies," he declared.

At last, and indeed I felt wearied, Hal pronounced that phase of our labors complete. Mark and Terry extracted the plank from the cavity with the same do-not-jiggle caution as before. With a different can of paint, green this time, Hal sprayed the paper again. This time he focused on the outer edges where the iron grains had clumped most thickly.

The paint had to dry. I checked my watch. I'd have sworn that hours had passed, but it claimed 12:30 A.M. Could the magnets have done things? These digitals, I don't understand how they work.

I put more coffee in Hal's hand and nodded him outside.

It was cooler by 20 degrees; I felt better at once. Parked close to the door, the Gas & Light portable crouched, its rotating amber lights flashing slowly like a dragon's eyes. The transformer's hum reminded me of monks droning deep meditations. The huge cable spool had perhaps four turns left; had they planned? Could it be chance?

I walked Hal twice around the building. "Now we try it out?" I asked.

He found a ledge to sit on, took an absentminded sip of the coffee, and gazed out into the dark beyond the yard's lights. "One or two other things first." He thumped his leg with the fist

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not holding the coffee. Thumped again. Restless.

I checked my watch. Still working, yes. The building's wall was abrasive and cold against my shoulder. Reluctant though I was, things needed saying. "We're hoping this will work," I said. "All of us. But I hope . . ." I tried for the right words, probably failed. "We hope you, well, won't expect too much."

It was a clear night. Perhaps in spite of the lights nearby he could see a few stars. He took another sip. "Sometimes the dragon wins."

That mordant chestnut took me unexpectedly. What other thoughts might he hold? "I'm thinking, well, later," I said. Surely, if he considered, he had to know he had no right to take possession of the life he saved. It would be a mistake, a dishonorable hope. "Presuming we . . . uh, get that far," I finished lamely.

"That's as far as I'm thinking," he said, tone level, fiercely controlled. He swirled his cup. "I just want her to be all right." He emptied the cup and threw it away. Standing, he nodded me toward the door. "Should be dry now."

Yes, there'd been time. I considered pursuing the matter, but now he was walking away. I followed, silent, one plodding step at a time.

Inside, Mark and Terry were getting the last iron grains off the paper. Hal had them clear a patch of floor and spread it flat. There, using the board for a straightedge, he had them fold the paper lengthwise along one of the lanes where iron had kept the spray paint from the paper. An unwieldy business. One of the Gas & Light men—He-Man Comix, I think—came out of their corner.

"Need more hands? Hey, c'mon, Howie. Earn your overtime."

With help it was quickly done, after which one side had to be folded along another line two-thirds of the way to the edge. A Christmaslike plaid of red and green lay revealed.

So far as my unskilled eye could see, the crosswise paintless lines that resulted were perfect extensions of each other, but all that signifies is the difference between myself and a man of technical exactitude. On hands and knees, Hal proceeded down the paper's length, his flashlight giving brightness where his shadow cast darkness, carefully confirming the matchup of each transverse line. More than once he used a draftsman's T square to verify or refute what eyesight told him. With a felt tip pen he added marks I could not read.

Slapdash? Definitely, but I can think of no way he could have learned what he wanted in less time. Thinking ahead, he'd shortened the task.

The hard floor did cruel things to his knees; he staggered when he stood up. He-Man Comix gave a steadying hand. Hal mumbled thanks, stood swaying with the pain melting out of his face. "Mr. Norway?"

His glance found me. Summoned, like a loyal trooper, I went to him.

"Here's the thing," he said. "It looks good, but the transverse field's got maybe 3 degrees leeway. We don't have good theory, and the lab data's rough." I felt the question in his eyes: should he proceed or give it up?

It wasn't a choice I wanted. Stop the business now and I would lie awake for-

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ever wondering had I been wise. "Are you confident?" I asked. Temporizing? Blippy right I was.

"No," he said. He rubbed an eyebrow with the dirty heel of a hand. "Want it too bad. Can't think sharp."

I felt then the cold bite of doubt, but my tongue was inert. Could I, after all, hold back the faith B.J. had given on no more than my own fumbling words? I stammered thumb-headedly, groping for language that would speak my mixed feelings. But the need to voice them evaporated with the arrival of the pizza driver balancing a stack of redolent boxes and a huge sloshing basket of cola with ice and, bless his heart, lemonade.

"Boss says you can just sign," he said. "Took some talking, but I told him what's happening. And normally we're open till three, but if you want he'll keep some people on."

I know that I blinked. I don't know what I said.

"Shucks, that's all right," he said with a foot-shuffle grin. "I make it into grad school, just hope I get into something that's half this important."

I mumbled of desperate measures, faint hope. He just kept that grin on his face. "Hey man," he said. "Don't you know there's a guy over there out to conquer the world?"

With an empty carryout cup in his hand, Hal was looking for someplace to toss it. Blood sugar rising again, he seemed already more assured. "Ready?" I asked.

"We'll try it," he said. "Where's that stuff from the spill?"

I'd forgotten all about it.

We found the box under a workbench with the handling gloves lying on top as if a gentleman had come calling. Also the film badges which, after a moment of qualmy misgiving, I passed around. Hal, I noticed, already had one.

"Initials on the back," he said with great sobriety, "under the number. Got to do this right."

Meekly I complied—N.S.N.—and clipped it to my shirt while Mark and Terry, worried-looking, did the same.. "Now?" I asked, and knelt to unfasten the lid. Hal shook his head.

"Puts out a lot of gamma," he said. And with a nod to enlist my help, we heaved it up on the bench. "We'll fish stuff out. If we've got to see, we use a mirror."

I'd been going to do something terribly dumb; sleepless as he was, Hal had been more alert. While I rubbed grubby palms on my trousers, he donned the clumsy gloves and somehow snapped the latch. With what looked like ordinary kitchen tongs he fished inside. "Should be safe," he said over his shoulder, "but stay clear. OK?"

Mark and Terry also kept their distance. What came out was a sealed plastic bag which, holding arm's length, he carefully placed midway along the MRI's examination table. Just as carefully, using the tongs, he shut the box. Had he thought of everything?

I think he had. Signing for us to remain where we stood, he collected a geiger I had not noticed previously.

"Note the readings?" he asked.

I looked around. Paper everywhere, but every piece was covered with scribbles, calculations, or sketches. I fumbled an envelope out of my pocket; a letter I'd forgot to mail. "System test number one," Hal dictated, speaking

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slow to allow time to write. "Twelve forty six A.M. Sample number one, contaminated glass fragment in protective plastic. Geiger reading before exposure . . ." He applied the wand to the sample. It *brrped* quite alarmingly, but Hal spoke as imperturbably as the classic elevator operator. "Range of fifty-seven to sixty-one, probably due to non-homogeneity and variable distance of sensor from the sample. Shall I repeat?"

"I think I have it," I said, rather breathless. He had me read it back. I doubt anyone else could have read my scrawl, and wish I could say my voice was calm. Perhaps it was; I make no claims.

He repeated the reading, fifty-eight to sixty-four that time. Then he was ready. "Better stay back, everyone" he said, nodding to the steel screen. "It . . . well, there's a chance we'll have some energy release."

Remembering the heat of that containment vessel—had it been only weeks before?—I understood. Meekly I took refuge and put my back against the wall. Glancing one way, then the other, I seemed to have set an example. He-Man Comix adjusted his safety hat, grinning an edgy grin. "Moment o' truth?"

Hal stood motionless at the pulse generator. I thought, yes, so would I; but now I think he was only checking the view in a mirror on the wall which let him see into the MRI's cavity. Even that he'd thought of.

"Ready?" he asked over his shoulder, hand drifting to the programmed sequence button.

"Go for it." One of the Gas & Light men spoke; I'll never know which.

Hal touched the button. I heard the ticky sound of circuits closing, snapping open, and other circuits flashing to life; and there was the crackly sizzle of electricity in connections that were less than perfect. We all, I'm sure, did not breathe, waiting for unknowable things. Only slowly did I realize they would not come.

"Didn't work, huh?" Again, it was a Gas & Light man. Again, I did not see who.

In that silence we would have heard a butterfly cough. Hal stood a moment longer, head bent. It had either worked or done nothing. "Mr. Norway?" He nodded me forward.

I suppose I responded adequately, but with a ten step head start he reached the machine well ahead of me. I was in time to help guide the platform as it came out of the cavity. The plastic bag was still there, scorchless and whole.

"Notes?" he reminded. I got out the envelope, rumpled now, and my ballpoint. He gave me time. I nodded.

"Exposure completed at . . ." He peered at his watch. "Twelve fifty-two A.M. Condition of test sample, eyeball impression . . ." He bent close. "Appears unaltered . . . plastic container intact . . . geiger reading . . ."

He'd left it back beside the pulse generator. Mark brought it forward. Hal fumbled its switches, scanned its dials, waggled its wand in his hand. With heart and soul at stake, I'd have felt the same reluctance. "Geiger reading?" I prompted.

He put the wand's tip a centimeter from the bit of glass. Not a whicker. He moved it back and forth across the envelope, then corner to corner. Deep silence gripped us all.

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His face showed nothing. Crossing to the workbench where the box of samples waited, wand before him like a shaman's charm, he flipped the lid back. In spite of all I should have known, the squabbling blast from the bipper shocked; but Hal, his face so plain he might have been doing numbers in his head, returned to where I stood and cautiously applied the wand to the sample again. Through a long silence, ballpoint in hand, I waited. All of us did, while Hal turned a knob one notch, then carefully another.

"Zero," he said, so quiet I was not sure I heard. But then, "Geiger confirmed operational. Mr. Norway, did you hear?"

We traded glances. Mark, there beside me, slowly stretched his mouth wide. "Got the bastard!"

"Italian navigator," Hal mumbled, nodding. I may be the only one who heard. Then: "You didn't fiddle it, did you? Not supposed to work, first try. Don't understand. Never!"

Regardless of how successful, though, one test was only a point on the graph. Having neutralized a microscopic sample, it was necessary to try with larger quantities.

"Of course," I said, and we began.

First, using a felt tip and a meter stick—yes, all the latest equipment—he ticked off twenty centimeter sections on the Teflon platform. Into each section he placed a specimen from the box, numbering each and giving it a two or three word description plus the geiger's readout. I scribbled as fast as I could.

Early during that business, someone touched my elbow. "Should I make another trip?"

The pizza driver; I'd thought he'd gone. Hardly the uppermost thing in my mind. Still . . .

My watch said ten past one. "Not so soon," I decided. "Say, quarter of two?"

"Gotcha." He grinned and was gone. Ah, youth!

Hal had waited, geiger still sniffing at the next specimen. "Zone three," he dictated. "Nylon blouse. Question mark the nylon. Geiger reads seven four five, spikes to eight ten, nonhomogeneous. Zone four . . ." He dipped tongs into the box. ". . . Swatch of hair with rubber band . . . uh, could you do this? Got to sit down a minute."

Terry accepted the tongs and the geiger while Mark scrounged a crate for Hal to sit on. I had not noticed how warm it had become; now I did, and then forgot again. Doing unfamiliar work and less quick with words, Terry went slower; my scribbling fingers were profoundly grateful. Reading the geiger, he stumbled. "Numbers jump around," he complained, but he did well enough. Grab-bagging for another item, he came up with something small and lace trimmed which he dropped back inside. "Don't want that one, Mr. Norway." I could only nod, though a glance told me Hal had not been unaware.

Had the cleanup men known our plans? I do not fool myself that information flows through official channels only. To the blouse and the clipping of hair, we added a fragment of floor tile, a large paint chip, an aluminum clipboard with its papers, the sleeve and shoulder part of a smock, the anteater

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nozzle of a portable vacuum cleaner, the collector bag from the same device, several more scraps of glass, an iron chisel, and a small woman's shoe that could break your heart. Hal had the fortitude, then, to take the geiger and go down the line; to my infinite relief, though, he spoke only numbers. He did not say what each item was.

Ready at last, I thought. It had seemed an age. Then, worried of details, I saw that some specimens were not centered perfectly. I touched Hal's wrist.

"It's all right," he mumbled. Even through his glasses I could see his eyes flicked nervously about. "Effect should be the same everywhere." He moistened a lip and found a new footing. "If it's not, we need to know."

So the platform was again rolled into the machine. Hal nodded the rest of us clear. "Lot more riding, this time," he said. And when we were safe behind the screen he touched the button as if all those volts and amperes would incinerate his ohms. Relays ticked. That bad connection sizzled again, the magnets hummed and strained metal groaned. At last, the deep, breathing quiet returned.

"Well, didn't blow up," someone said in the silence.

Hal shut off the power and used the tongs to pull the platform out. Holding the geiger's wand at full arm's length, he looked my way. "Mr. Norway?"

I fished the envelope from my pocket. Gettysburg Address, I thought absurdly. Would the Smithsonian want it? At this strange hour, was I sane? "Zone one, floor tile fragment," I specified, and waited. Silence answered.

Had he heard? "Floor tile?" I repeated.

"Zero," he said.

Dared I trust? "Say again?"

"Zero," he said, flat voiced.

"Zone two, clipboard," I said.

"Zero."

"Again?"

"Zero."

"Zone three, sleeve of smock, folded in thirds."

"Zero."

"Hair?"

"Zero."

"Paint chip?"

The geiger's warble and Hal's groan came together. I saw his shoulders sag. "Paint chip?" I repeated.

"Twelve," Hal said. A dead word. "Twelve." He looked for a place to sit down.

Terry was on the other side of the platform. He stepped forward, crouched down. "Careful!" Hal shouted.

"Maybe this is it?" Terry asked. He held up the handling tongs.

Even in that moment of fatigue and disappointment, Hal was quick. He let the wand sniff the tongs' jaws. The geiger wheeped. "Drop it!" he said.

Terry didn't have to be told twice. It clattered on the floor.

"What about the gloves?" I suggested.

We found where he'd left them on the workbench. Hal let the geiger sniff. It shrieked. "Off the scale," he reported, a combination of relief and wonder in his tone.

"And the paint chip, now?" I asked.

He tested. The silence was long, distrustful. "Zero," he said at last. "*ZERO!*"

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I was reluctant to rejoice too soon. "Should we make sure it didn't just now quit?"

Hal looked at me, squeezed eyes shut as if they hurt, glumly nodded. He located the gloves again, waved the geiger's nose past. It delivered a heart-lifting warble.

He turned my way. "Mr. Norway, I think we have it."

Of course we didn't; not yet. But I had to be gentle. "I think, before we try it on a person, we should test it on something alive."

Hal looked like a boy who had stubbed his toe. I was right and he knew it.

"I could go find a stray dog," Mark offered.

"That won't be necessary," I said. "Wait here." And to Hal I said, "This may take a while. Perhaps you should try for a nap." "Don't think I dare." Indeed, his feet were not holding still. Yes, I could sympathize.

"I will try to be quick," I said, and headed for the stairs.

From my office I phoned Gordon Foulkes, who answered with a promptness that startled. "Sorry to get you up at this hour," I began.

He let me say no more. "Oh, you didn't wake me. After our conversation this morning, I thought perhaps I'd be wise to sit up with a good book. It's that unfortunate girl, I presume."

"Well, yes." I hadn't told him all that much. Only that we might need to, ah, borrow some of his rats. "If you could tell me which we can use without interfering—" I said.

He cut me off again. "Say no more. I'll be down directly."

"That's really not necessary," I assured him. "If you'll just say—"

"Nonsense. I've worked with those beasties thirty years. I would, I think, have insights to contribute." Before I could renew my objection, he was off the line.

For possibly a minute, bewildered, I held the dead phone. What box had popped open now?

Small matter. Control had not been mine for some while. Taking a breath, I tried to phone B.J.'s office; no one answered. At this hour, I should not have expected otherwise.

With a fresh pot of coffee to ensure my welcome I returned to the workshop. Idle, restless, Hal had put another batch of specimens into his apparatus. Its drone nagged my nerves and the firefly wink of lights on the pulse generator's panel was as intelligible as pre-Harappan Urdu. The sputtering connection to one of the rods had been corrected. I made rounds with the coffee. Fingering fatigue from an eye, Terry sat heavily on a trestle. The Gas & Light men were over in a corner with open lunchboxes. Still here? I inquired as to their plans.

"Work order says stick around," the crew foreman said. He pushed back his plastic hat to rub a glistening baldness. "Long as you're working, or another crew comes to relieve. 'Mong other things, what we got here's a temporary job. Things could happen. Said something about you'd maybe need some other help, too."

Over my shoulder, I watched Hal and Mark removing the platform from the MRI's cavity. "Not for the moment, at least," I said.

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One of the other men was peeling a banana. He paused. "Hey, this the place that girl had an accident?"

"Another building," I said.

"Yeah. And this got to do with that. Right?"

Uncomfortably, I nodded.

"Uh huh." He concentrated on his banana. "Well, I got a daughter in fourth grade. Teacher told 'em about it. Had 'em folding paper birds yesterday." He shrugged. "Don't figure how that helps. Connected somehow."

I filled his cup. "More, perhaps, than you know," I said, and thought how pitifully we clutch for hope. Hal was probing the geiger at each sample on the MRI's platform. This time he'd included the tongs and the gloves, and added some rolls of Polaroid film. "Each of us," I said, "does what he can."

The geiger was quiet, and I worried it had gone bad. Irrational, I told myself, but Hal must have shared my thought. He raised the samples box lid, and the geiger obliged with its obnoxious, familiar tweek. Another time it would have rattled my nerves. Now it soothed. He peeled the backing from a few frames of the Polaroid film, discarding them after a glance. The rest he gave to Terry who methodically continued the job.

Hal's cup was foul with dregs. I gestured with the pot but he put a hand over it. "Not now. I . . . nerves." He shook his head. "Much longer?"

"Gordon's coming to help," I said. With a pained look he started to turn away. The sound of a door being opened caught both of us. Gordon's head appeared. "I say, is this where you want the *little* chaps?"

I found a clear spot on a workbench for the coffee pot. Everyone, it seemed, was voicing the affirmative.

"Back in a jiffy," Gordon said, and was gone. I found a slice of half cooled pizza and put it in Hal's hand.

Good as his word, Gordon returned five minutes later with a stack of plastic cages, each containing one inquisitive white rat. He seemed instinctively to know what we needed. "Ideally, this should be done over several months," he said, carefully stacking the cages on a bench some distance from the one with the box of samples. "Perhaps a year."

"We don't have days!" Hal groaned. "Every hour we—"

"I realize that," Gordon cut him short. "Therefore . . ."

With a few crisp sentences, he established laboratory discipline and an experimental protocol. Three rats would be used in each test, two contaminated and one unexposed as a control. At least two test runs; preferably three. One rat from each run would be dissected and sensitive tissues examined both chemically and by microscope. The others would be kept alive for observation, perhaps to be dissected later. Each rat would be marked, spray paint or felt tip or better yet both. Careful notes would be kept. From a pocket of his tweed he produced a hardbound notebook, all pages numbered and cross-ruled but otherwise pristine. I had the honor of making the first entry, date and time. A new load of pizzas arrived.

Driven by the need for haste, we'd have been plunging recklessly headlong without Gordon's steadying hand. We

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owe him much. When our first test with rats was complete, with the rats still bright of eye, and the radionuclides that had been through it with them made harmless, Hal's patience broke again.

"Call the hospital," he told me. "Say we're ready."

Gordon, perched on a stool like a tennis judge, looked up from his notebook and gestured with his pen. "I suggest we proceed as we have. Three rats again. And perhaps this time could we have the radioactive material inside the cages instead of on top?"

"At least, can't we call the hospital?" Hal pleaded. "It'll take them time to get her here. All right?"

"Young man," Gordon said. "What makes you think they will send her on the basis of what we have learned so far?"

"They've got to. It's the only chance she has."

"I think they will not see it that way. Have you discussed the matter with them?"

Hal's astonished look said more than words. With a numb feeling I realized I had not considered that, either.

For Gordon, that settled the question. "Run number two," he declared, and made an entry in his book. "If our result is replicated, then perhaps we may think about calling."

Hal seethed, but gritted teeth and bent his head. Mark, Terry, and one of the Gas & Light men each brought a rat, randomly chosen, from our sacrificial supply. Hal paced while Gordon saw to the crayon marking of each cage, spray paint applied to the tail, and a number felt tipped on the hindquarters. The pizza driver made notebook entries. When, finally, Gordon allowed Hal to select radionuclide specimens from our dwindling supply, I judged it safe to go upstairs and see to our coffee maker again.

The phone in my office was ringing. How long I have no idea. Of course I answered. The efficient woman at the other end said, "Mr. Truscott asked me to keep trying. I'll page him now. Please hold."

Were the inventor of Chinese water torture to call me on the phone, I would put him on hold as a matter of simple justice. Caught in the anxiety of the moment, however, and for B.J., such thoughts evaporated. "Certainly," I replied.

B.J. came on with, I must say, reassuring promptness. He was at the hospital, information I took with tremendous relief but without time to savor.

"What's the situation there?" he asked.

Only a few words brought him up to date. He was pleased to hear about the rats. "And Gordon's running that show? Good. He plods, but when he gets there you know where he is."

I had said that myself once. There is pleasure in hearing your judgments repeated by others. Then B.J. said, "I'm having trouble making the docs take this seriously. Not surprising. If they didn't know me, they'd have chucked me out hours ago. Listen, could you bring your young man out here? Maybe if he talks they'll catch on this isn't a nut case."

I must admit that, when I paused for thought, I'd pondered the question of sanity. Against the fundamental forces of the Universe, what is Man? Who were we to joust dragons? On the other

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hand, I'd seen enough to give some hope of success. "I'll see what he says," I told B.J. "Should I call you back?"

"Just come," he said. "I don't like interruptions when I'm arguing."

Hal nearly fell asleep en route to the hospital. Slouched down, he said nothing the whole distance. When I glanced across to him I saw his fist unclench and clench again in the glare of lights we passed. Stopped for a traffic light, I said, "Try to remember they are reasonable people whose goal is the same as our own. It is just that they deal with lives at hazard every day. They need to be careful."

He didn't answer. I hadn't expected him to. In the flash of a car's headlights as it turned ahead of us, I saw him grimace with pain.

The business with the rats had gone well. Gordon, however, had insisted that before he would confirm our results, he had to observe his little beasties for at least an hour. "There could be physiological damage, neurological damage, possibly even structural injury. Until we explore, we do not know."

Myself, I was grateful to have an excuse for taking Hal out of that fevered place. To make him cool his heels with nothing to do would have been barbarous.

The hospital complex stands in splendid isolation midway between our modest city and the one immediately to the east. Why there, I've never asked. At this hour, its parking lot was blessedly empty under the pitiless blaze of lights that permitted no shadow to live. Crumbling patches and potholes everywhere. My wheels thumped in several.

Hal was out of the car before I had the engine off, and halfway to the entrance before I had it buttoned up. When I reached the lobby, I found him standing forlorn, bewildered by the sudden knowledge that he did not know where to go from there.

Fortunately the reception desk was manned, even at this heathen hour. The tiny, small-boned lady with a dried apple face was delighted to help. "You're Mr. Norway?"

She'd been told to expect us and gave clear, succinct directions. "I do hope you can do something," she said.

Did the whole world know?

The elevator was solemnly quiet, uncommonly gentle. The corridor it opened to was windowless, undecorated, plainly lit. Dauntingly long. We passed side corridors with utilitarian placards declaring one the Coronary Care Unit and another Intensive Care. Arrows would have taken us to Surgery, X-ray, and Emergency far beyond. B.J. emerged from a waiting lounge midway along that fearful trudge. Several others trailed.

I do not remember all the names. There was Dr. Fortescue of course, and one of his residents. A Mr. Templar, who was the hospital administrator, and a lawyer for the hospital. At B.J.'s elbow was Morton Hayes of Hayes, Hayes, Hayes and Philadelphia, our own law firm. Fussy little man. The one not named Hayes is actually Pilliciotti, but in stressful times we need our small amusements. Also a dumpy, small woman with frowsy hair and, if I remember right, a man from the FDA

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whose nose was already snuffling the wind; it's possible he turned up later.

Dr. Fortescue was a tower of weary dignity. "Would you like to look in on her?" he suggested.

"Is she awake?" Hal asked quickly.

"Sleeping, I believe. This sort of thing, there is malaise but remarkably little pain at this stage."

"Then, if I could . . ."

She'd been placed in Intensive Care. The hall outside her cubicle was starkly lit; within, all was subdued. I noticed equipment and supply stands, an IV rack delivering saline drip down a thin, twisty tube, and barren walls. A window looked out on an infinite sprawl of tar-and-pebbled roof. A sad place, I thought, for what might be one's last view of the world.

Metal screens had been positioned around her bed. Hal stopped in a gap between them. Looking past his shoulder I could see only a nondescript shape beneath a sheet, a small hand, the gleam of a bare brow. Her mouth and nose wore a breathing filter. Her head was cowled like a nun's. After only a moment Hal turned away. Quickly I stepped aside.

"Let's go talk," he muttered, already moving.

We trooped back to the lounge. Much of it was dark, but I noticed enough slumped figures on couches and chairs to remind me that this was a place where private tragedies played to their end every day of the year. A bony woman sat, arms tightly folded, staring at a mural the darkness did not let her see. Under a lamp, a white bearded bald man restlessly pawed through rumpled newspapers. Others fitfully slept. In a corner, an unwatched television cheerfully tried to sell shampoo. Live a little, it urged.

Dr. Fortescue nodded us into a smaller cubicle identified bleakly as a family conference room. A sofa and a coffee table, lampstands and comfortable chairs. He closed the door.

Hal perched on the sofa's arm. Dr. Fortescue stood with the coffee table's edge against his shins. "Suppose you tell us what you hope to do," he said.

"Stabilize the radionuclides in her body. All of them."

"Isn't that a contradiction? Like, shall we say, reassembling Humpty Dumpty?"

"No sir," Hal sad. "Have you seen Chang and Abfalter's paper on . . . ?" Half closing his eyes, he spoke mechanically. " 'Magnetic Moment and Deviations from Sphericity in Metastable Nuclei'? In *Physical Review*?"

Dr. Fortescue did not actually roll his eyes. His shoulders moved slightly. "I keep abreast with radiological literature," he said. "*Physical Review* is not concerned with clinical applications."

"It was also reported in *Nature*," Hal said.

"That also, I do not see. Nor do I see that it has bearing on the matter now concerning us. We have a serious case of radionuclide poisoning. That is what we must deal with."

I saw Hal breathe deep, straining for patience. "So the radionuclides have to be made stable where they are."

Dr. Fortescue humphed a bitter chuckle. "In situ. Yes. Except that the only way would be to selectively bombard each of those atoms with accelerated particles of precisely the correct energy. Such a technique does not exist and

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never shall. I'm sorry, young man, but that—''

''I've got a different approach,'' Hal said. ''I . . . I think it has a chance.'' He looked down at his fist and carefully unclenched it. ''The basis of it—'' He stopped. ''Are you familiar with how a nucleus decays?''

The doctor turned wary. ''I know the basic modes of emission,'' he said. ''Alpha and beta particles, gamma rays. I have a working knowledge of half-lives. Is there more?''

''Quite a bit,'' Hal said. ''What about nuclear structure? Anything at all?''

''Irrelevant to my work,'' Dr. Fortescue said, ''and to the current problem. We are attempting to remove the foreign atoms by chemical transport methods, so far with only limited success. The only practical treatment we have. Unstable nuclear structures are the underlying cause, of course, but we have no—''

He stopped. Not until then had he grasped there could be things not dreamt of in his philosophy.

''You disagree?'' he asked.

''Depends on what you mean,'' Hal said. ''You see, well, I'll have to start pretty far back. You probably think a complex nucleus is just a lot of protons and neutrons crammed together, sort of like a popcorn ball. Most people do. Am I right?''

''You know better, I presume.''

Hal bristled but spoke calmly. ''It's very misleading, sir. It's closer to a true statement to say it's a dynamic system of—we call them particles, but it's just as accurate to describe them as recursive packets of electromagnetic radiation—''

''I think you've lost me.''

Grimacing, Hal tried again. ''Accept that it's a localized combination of particles in continuous interaction with each other—orbiting each other within the nuclear zone, interpenetrating each other—they're not solid like marbles, you understand, with some forces pushing them apart and others pulling them toward each other. And—this part's still theoretical—it's possible the orbits have more than the three dimensions we're familiar with. I don't mean time, either: that's implicit in the concept of orbits. But actually, talking of orbits is a crude concept, too! It's only a . . . an easy way to think about something that's a lot more complex. But it does help you visualize.''

Perhaps it was only that my own mind was being stretched in exotic dimensions, but I suspected Dr. Fortescue must also be getting more than mildy bewildered. He settled into a chair. ''Your point is?''

I definitely saw Hal's own internal forces fight for balance. With a gesture which may have been less than subtle, I tried to suggest a need for steadiness.

What he said was: ''All right. In a stable nucleus, all the forces are in perfect balance. Equilibrium. For a nucleus that's not stable, they're not.''

''Obviously,'' Dr. Fortescue said.

In spite of himself, Hal laughed. Perhaps I laughed myself. Then Hal got his breath back.

''But when we say unstable, for an isotope with a half-life of, say, one hundred years—for a nucleus that's a long time. You could almost say forever.'' He put up a hand to forestall another interruption. ''I know. An isotope with a hundred year half-life is

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dangerously radioactive. Deadly. But that's another frame of reference. What I'm trying to say is the forces in a nucleus like that aren't very far out of balance. Depending on the configuration you started with, it's close enough that it holds together just the way it is anywhere from a month up to thousands of years. It's only that we don't know the starting configuration of each individual nucleus that forces us to think in terms of half-life. On the nuclear level that's not what's happening at all."

"Nevertheless, that is how we are forced to consider it," said Dr. Fortescue. "The number of radioactive atoms in that poor girl's body is beyond the trillions; for practical purposes, infinite. A chemical removal process is the only treatment available."

"But if we could reconfigure them where they are—" Hal tried to say.

Dr. Fortescue chopped him off. "I do not question that you physicists can bombard a nucleus with all sorts of peculiar particles and produce almost any variety of results. Newspapers are full of it. However, the atoms you want to affect happen to be dispersed within a living person's body. We cannot do what you want done without destroying her body at the same time. I'm sorry, young man. Impossible."

"I can do it," Hal said.

"What? Young man, I sympathize. The matter is desperate and you are emotionally involved. That disqualifies you. What is needed is objective judgment and, forgive me, I must say you do not have it."

Hal went rigid. "I am not . . . emotionally . . . involved."

He spoke with freezing exactness. I could not stay silent. "Excuse me. He has done it already with rats."

Dr. Fortescue turned his scowl my way. "I have seen nothing in the literature which so much as hints—"

"We expect to correct that," I said.

The scowl became—I'm not sure how—a cautious frown. Leaning forward in his chair, feet pulled back, he addressed Hal more gently. "How does it work?"

Hal collected himself. He fiddled with his fingertips. "I . . . I'm not sure I can make it clear. The . . . thing about unstable nuclei . . . well, stable ones tend to be spherical, and the unstable ones have . . . well, other shapes. And the ones that are most unstable are the ones most deformed. That goes all the way back to Bohr's liquid drop model, which now we know was awfully primitive. What it means is that the particles orbiting in the outermost shell—"

"You mean the electrons?" Dr. Fortescue asked.

Emphatically, Hal shook his head. "I mean the nuclear shell. The protons and neutrons, they're orbiting too, or their components are. In shells. That is, it's possible to think of them that way. What's actually happening, we don't have a good macroscopic analog. Think of an onion, and try to think orbits at the same time. That's as close as I can explain it without getting into intersecting planes and resonance and those extra dimensions I mentioned. And . . . well, there's energy levels within each shell and between the shells, just like with the electrons. Am I getting across?"

At some point, Dr. Fortescue had leaned back, putting fingertips together.

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He looked absorbed. "Proceed," he said finally.

"So we know the nuclei we want to work on are the nonspherical ones. Right?"

"It follows," Dr. Fortescue conceded. "However, it's a long way from that to—"

"I'm getting to that," Hal said. "What's important, when a nucleus decays, what's happened is that one of the particles got so far from the . . . center where the interacting forces which hold a nucleus stable are concentrated, that the particle's not completely governed by those conditions. Sometimes, then . . . well, several different things can happen. Most frequently it's a neutron that breaks up into a proton and electron, with the electron escaping from the nucleus, either because of an interaction with the electrons in the innermost electron shell, or interaction with other particles in one of the outer nuclear shells. That's beta decay. Sometimes you get several particles in the outer part of the nucleus combining to escape as a helium nucleus. That's alpha decay. Sometimes it's something more exotic, and with just about all the reactions there's gamma emission, sometimes a neutrino, too. But in all those cases, the precondition has been that the nucleus deviated from spherical far enough that the event could happen."

Dr. Fortescue removed his glasses, polished them with a handkerchief, inspected the result. He'd been given at least a textbook chapter's worth about nuclear structure, and so had I. Hard swallowing at this hour. Several of the quiet ones among our little conclave shifted uncomfortably. B.J. cleared his throat, settled again with eyes on Hal.

"Interesting," he said. "What's your line of attack?"

I'm not sure Hal knew who B.J. was. To my knowledge, they'd not been face to face before, and just then Hal's attention was entirely on the task in front of us. Later, I know, he was aghast when I told him. Then, however, only his science mattered.

"What Chang and Abfalter did," Hal said, "they adapted Schneggenburger's technique for measuring gamma-ray polarization to the investigation of complex nuclear structures, and applied it to repeat a lot of the previous piecemeal work with a single lab setup. What they were after was a consistent set of data. One thing they got—what the paper I mentioned reports; just luck, really—is that the destabilizing deformities in a nucleus tend to concentrate in a plane at right angles to the magnetic axis of the nucleus. Probably one condition has an effect on the other, but that's speculation. What it means is that it's possible, with a strong magnetic field, to orient all the unstable nuclei so their . . . their planes of distortion . . . will be parallel to each other. Simple application of magnetic resonance phenomena." He looked at Dr. Fortescue. "You know how the imagers work, don't you?"

"In a general sort of way," Dr. Fortescue said, sounding careful. "But they work on hydrogen atoms. You're saying—"

"The imagers work on all the atoms," Hal said. "It's just that it's easiest to pick out stimulated hydrogen radiation from the background of all the

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others." He took a breath. "I'll explain the spin glass concept if you'd like."

"Thank you; if that isn't necessary—"

"I don't think we need it," Hal said. "For what we want to do, it's enough to know we can arrange all the unstable nuclei into an ordered configuration, so they can all be worked on together."

"But they're still individual atoms, still dispersed," Dr. Fortescue objected.

"That doesn't matter," Hal said. "Once they're aligned, we can apply a combination of other fields at right angles to the first to . . . I guess you'd say nudge . . . the noncircular orbits into something less elliptical. That has the effect of making the nucleus less prone to what we think of as spontaneous decay." He hesitated. "I guess what I'm saying is, the decay isn't really spontaneous. What happens wasn't understood when they developed the nomenclature."

An impromptu seminar at 2:30 A.M., I thought, was neither the time nor place to correct the language used by physicists. The lawyers, theirs and ours both, sagged in sleep and I, I must admit, felt more than slightly fumble-headed.

Dr. Fortescue's resident, whose white coat had a name badge which, I'm sorry to say, I never took note of, was wide awake. "Wait a minute," he said. "Magnetic fields don't interpenetrate. How can you hold with one and then apply the other?"

"We don't," Hal said. "We have to alternate; a pulse of one to get them oriented, then the others to nudge, and then another orientation pulse and another nudge, and so forth." As if it was simple and obvious. "Most of the nuclei we need to deal with have the inertia to hold them steady long enough. Anything with atomic weight higher than about ten. For beta emitters, it's a direct ratio, one to the atomic weight minus one. Alpha emitters, it's more difficult because you're dealing with a factor of four, but there's still a good advantage in most cases." He looked around uneasily. "I wish we had a blackboard."

"I think I get all that," the resident said, but cautiously. He still wore a frown. "What about the shells of electrons surrounding these nuclei? Don't they make a field? Wouldn't they block you?"

"Most of the time, they neutralize each other," Hal said. "But you're partly right. Actually, what we have to do is, well, distort the electron shells so that their field interacts with the nucleus in a way that will moderate the nuclear distortion. Essentially, it's reversing the process that normally, without intervention, would pump the nucleus up to a . . . well, an emissive condition. That's all we have to do."

Thoughtfully, the resident thumbed his jaw. "Isn't there a chance you'll kick it over? Make it decay?"

"Happens with some," Hal admitted uncomfortably. "The ones that were primed to emit before we started. So for a nucleus with, say, a few microseconds half-life, we couldn't have much effect in terms of macroscopic time. And fissionables, they're so out-of-spherical . . ." He shrugged. "Maybe yes, maybe no. But for the rest, well, it's like resetting the clock. The instability will build up again, sure, but I think at

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roughly the same rate as the original half-life. For cesium 137, it's about thirty years. That gives us a lot of time, and with that much time you can do a lot of things to get the stuff out of her; and if you can't, well, we can go back and set the clock to zero again. You see?" He spread his hands.

The resident turned to Dr. Fortescue. "He talks it pretty good, sir."

The ball—perhaps I should say the nucleus—was back in Dr. Fortescue's lap. My own thoughts, by then, were confused; much as I wanted Hal's effort to work, I felt terrible doubts. So many unanswered questions.

"You are claiming," Dr. Fortescue said, "overnight, you have developed techniques that have slipped past thousands of more experienced researchers. How likely is that?"

Hal looked uncomfortable, but said nothing for a moment. B.J. roused himself from quietly watching. "See here. That's not a valid argument."

Dr. Fortescue turned only his eyes. "My experience has been that desperate people embrace strange remedies. This situation is ripe for mistakes of that kind."

"Excuse me," Hal said, diffident but nervously swinging his foot. "We've got sort of a joke in physics. You know, the kind that hurts because it's got so much truth? We say our best ideas come before we've learned enough to know they're wrong."

"That's claiming a lot for yourself," Dr. Fortescue scolded.

I thought Hal would have to back down. Instead, his chin steadied. "On the shoulders of giants," he said. Then, with an awkward, half-embarrassed smile, "Also, it got my attention."

The doctor wasn't amused. "You seem to think," he said, "all you need is to goldberg some bus bars like this comics character . . . what's his name? Strong?"

"No, sir," Hal said, chin up again. "It's . . . it's looking at the problem from a different side."

Dr. Fortescue looked to his resident, but no fresh thoughts came.

"It's seeing what the real problem *is*," Hal said.

In that quiet, Dr. Fotescue settled back in his chair. He placed his fingertips together. He breathed out slow and long. "So you would say," he said with ironic weight, "God is not playing dice with the Universe?"

"Einstein's complaint?" Hal contemplated his sneakered foot. "I'm not saying quantum theory's wrong, sir. It, well, it helps us understand a lot of things. We couldn't have got where we are without it. But it doesn't really apply here, because we're not trying to observe: we're . . . we're intervening. We're imposing control." He flexed a toe. "And Einstein wasn't wrong. It's more like roulette."

No one laughed, but I think we all relaxed a little.

I should point out that Dr. Fortescue was not a rock-headed man unwilling to accept new things. He was a careful man borne down by the knowledge that, at every step, he had to do the right thing. Simple enough in most circumstances, but that night it was clear to no one but Hal what the right thing was. Should a wise man blindly follow?

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"You say," Dr. Fortescue said to me, "he has done all this with rats?"

Hal gave me no time to collect myself. "We didn't have time to do it right," he interjected. "But we put rats through the process the same time as radioactive samples, right next to each other, and the samples were rendered stable. That's good enough, isn't it?"

"The rats survived?"

"Well, uh, so far. We only did it . . ." He checked his watch. ". . . seventy minutes ago."

The hospital's lawyer opened his eyes just long enough to turn them toward heaven and squeeze them shut again. Dr. Fortescue merely looked grim. "It remains possible they were harmed irreparably. Death is not always immediate."

"We're aware of that," I said. "Gordon—Gordon Foulkes of our lab, he's our rat man—has insisted on observing them for a while."

"A while?" Scathing scorn.

"Gordon wants to observe them, do some tests. Neurological and physiological, both. When we left he was putting them through some routines which test for brain impairment: motor, learning, perception, all that sort of thing. He mentioned a few physical things, also. Then he plans to sacrifice one from each group, dissect and investigate for microscopic damage. He's a very thorough man."

"I do not know him," Dr. Fortescue said. "Regardless, I must say that whatever his competence, such procedure as you urge I could agree to only after months of investigation. Possibly years. You are suggesting a precipitate dash into unknown territory. The consequences are completely unpredictable."

"So we just sit around and let her die. Is that it?" Hal demanded.

It seemed a good moment to consult my watch. "Perhaps, were I to phone Gordon now, he might have a preliminary report. Is there a phone?"

The Intensive Care waiting room had an entire wall of coin phones. Thanks to all those pizzas, my pockets were flat; before I could fumble for my card, B.J. put his card in my hand. Gordon answered on the second ring.

"How are they?" I asked.

"The little buggers? Disgustingly healthy for the moment, except for the one I just cut up. Blood counts slightly down, but normal range. Otherwise . . . you are having trouble with the physicians, I presume?"

I admitted as much. I did not add that wisdom tore me in several contradictory directions.

"Just so," Gordon said. "The one in charge, is he there? Good. Perhaps if I could talk to him . . ?"

Dr. Fortescue had gone down to Intensive Care. Leaving the phone dangling, B.J. standing guard, I found him at the nurses' station with a clipboard in his hands. For just a moment then, before I summoned him back, he looked like a very different person than the one we had been arguing with. Worn, and with a few added years behind him. Then he followed me. Clipboard under his arm. Silent, he accepted the phone.

They talked for a while. Probably it seemed longer to us than it was. Hal fidgeted, paced a few steps one way, then another. Once he drifted several yards down the hall toward Intensive

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Care but stopped and came back. He sat down on a divan. A moment later he was on his feet again.

Dr. Fortescue hung up the phone. He stood looking at us, then nodded us back inside the conference room. "A very thorough man, as you say," he told me. "However, his results are terribly preliminary, as he himself admits." He nodded to the hospital administrator. "Mr. Templar."

Heavy and grey, the man got up from his chair. Beside him, their lawyer also rose. Templar glanced a question to the doctor, who nodded. The three of them adjourned to the corridor.

The small woman—I had hardly noticed her until now—edged forward in her chair. "You're Hal?"

Hal had been jittering his weight from one foot to the other. He stopped. Nodded. Waited.

"She told me about you." She let it hang and Hal backed off a step and wouldn't look straight at her. "Do you honestly think there's a chance?"

"Can't say," Hal mumbled. His face and voice both spoke of pain. "I know it's, well, risky, but don't you see? It's the only chance she's got."

She looked away from him, settled back in the chair, and looked even smaller than she had. One of her stump-heeled shoes came off. Suddenly she was merely sad and old.

"She was very close to her father," she said. "You have to understand. He betrayed us. Lied to us."

I could feel her bitterness bleeding out. Too much, I thought, and it had nothing to do with our business now. I must have had a queer look on my face, because she turned my way. "Men do that," she said.

Wearily I nodded. "Among others," I admitted, though at this late date I could not hope to soften the sting.

"What did you do to her?" she asked Hal.

A slap would not have frozen him so abruptly. "I didn't . . ." With pain he looked to me, then to her, then all around. "I don't know what happened. She just said . . ." He threw a hand down. "I'm not emotionally involved," he stormed, and blundered out into the waiting room. There, thoughts unknowable, he stood and watched the television where, for perhaps the millionth time, John Wayne was saving Iwo Jima for truth and glory.

The ex-Mrs. Hobart stayed in her chair, bitter mouthed. She took off her glasses, dabbed her eyes.

Dr. Fortescue returned with Mr. Templar, the lawyer trailing like a minor functionary of a royal court. Hal drifted back on wooden feet. None spoke until the door was closed.

"We are agreed," Dr. Fortescue said, "that neither I nor this hospital can countenance the procedure you suggest. Further, I must warn that federal regulations would make such an effort illegal. I am very sorry." Turning, he reached for the doorknob.

"A minute, please." B.J. got up from his chair; not much more than my own height, but broader shoulders. Somehow he projects a feeling of power. "What if she just checks out of here?"

"We recommend against that, also," said Dr. Fortescue. "This is not a hotel. Her life is in danger."

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"You've already said you can't help her," B.J. said.

"We can sustain her for a while. We can make her more comfortable," the doctor said stiffly. "More to the point, we would not do more harm than has been done. We cannot do miracles, and we are skeptical of persons who announce they can."

"What if she wants to try Lourdes?" B.J. asked. "Would you let her?"

"It is not a question of permitting or not permitting," Dr. Fortescue said. "In my career I have seen more than a few unexpected recoveries, some of which may have been psychogenically induced. In matters such as this we give our considered judgment. Each case is different. We do not dictate. We give the best advice we can."

Turning, B.J. had a few quiet words with Morton Hayes. I don't know what was said. Nods were exchanged and, I presume, decisions made. He returned his attention to Dr. Fortescue.

"If you don't decide, who does?"

"The patient," said Dr. Fortescue. "If she is not competent for reasons of awareness or mental stability, responsibility passes to the immediate family. If none can be located, which I believe is not the case here, it becomes the province of a court of law." He gave a glance to the hospital's lawyer. "Forgive me. I believe we have digressed into your profession. I had no wish to presume."

The lawyer shrugged. "Doing fine."

"Let's go see what she says," B.J. said.

"The patient is asleep and should be allowed to sleep," Dr. Fortescue objected. "She will need all her resources for what lies ahead. Also, in cases of this sort there are frequent reports of mental deterioration. Any decisions made by her could be legally challenged." He looked to the hospital's lawyer again. "Correct?"

"You got it."

"I believe we have a next of kin here," B.J. tilted a thumb toward Mrs. ex-Hobart. She shrank and, had she been able, would have vanished into the upholstery.

"What do you want me to do?" She had her glasses back on; I don't know how much she saw. "What could I say?"

B.J., Morton, Dr. Fortescue, and the hospital's lawyer converged like players on a loose ball. Hal hesitated only a moment, then moved in also. Mr. Templar and I were left by ourselves.

"There was a time," I told him wistfully, "when I thought a hospital's business was to save lives."

"It is," he rumbled. "When we know how."

Every four hours they replaced her breath mask and swabbed out her mouth. She was coughing up radioactive phlegm and, though the benefit was marginal, it seemed reasonable to get as much of the cesium out of her, promptly, as they could. When they woke her at three A.M. for the procedure, her mother, B.J., Dr. Fortescue and the two lawyers went in. I had thought Hal would go in too, but after talking to them—rather urgently, I thought—he hung back and leaned against the corridor wall, head down. In that Spartan place of cream-painted walls and not a scrap of decoration, he looked terribly desolate.

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After a while both the nurses came out, one stopping at the nurses' station to update records, the other walking past us down the corridor with the radwaste canister. Hal came alert as she passed. He took a step toward the wide open door. No one else emerged. The hall was quiet but we heard no voices. Hal turned his face to the wall.

Doubtless our vigil seemed longer than it was. When they came out, all clustered together, all of them slow and silent, Hal stepped into their path expectant as a cat.

"She'll sign and her mother will sign," B.J. said. "And I'll sign." His eyes held a lion's challenge, and he made a demurring gesture. "We've been holding the can ever since she got crapped on. Signing doesn't make a scrap of difference."

"Yes it does." The hospital's lawyer said it. "Compounded responsibility, unsanctioned procedures, reckless haste . . ."

B.J. turned his glare that way. "We've been through that."

Hal set both feet square. "If you don't mind, sir, I'll sign. Maybe the company's responsible for the accident, but once we start doing this, well, if it goes wrong, it's my fault. All right?"

B.J. looked a question to Morton, who looked unhappy. "Good Samaritan laws," he said. "Murky stuff. Might hold up, might not."

"More the merrier," the hospital's man shrugged.

"I hope you understand what you're doing," Dr. Fortescue warned.

"I've got to," Hal said.

"Why'd you want us to keep your name out, in there?" the hospital's lawyer wanted to know.

"Might have affected her thinking," he mumbled. "I . . . I'd rather not talk about it. You didn't, did you?"

"Son," B.J. said. "Either we're all heroes, or we're goats."

"Yes, sir," Hal said, firm as stone. "Am I allowed to sign?"

"Are you licensed to practice medicine in this state?" The hospital's lawyer again.

"I'm not a certified lifeguard, either," Hal said. "But if somebody's going to drown, should I walk away?"

The lawyer stood there, stiff fists at his sides. "I'll go get the forms," he muttered, and walked away.

Dr. Fortescue raised himself to full stature. "In spite of our differing judgments, young man, I wish you luck. I mean that sincerely."

"Yeah. Sure." Hal shuffled his feet. "I understand." It was all on him now. Soiled T-shirt and threadbare jeans, hardly more than a boy and too long without sleep. Hair uncombed. How could anyone believe?

While we were away, Mark and Terry had gone over the electrical connections. So had the Gas & Light men. Hal looked things over and announced another test. Iron filings and some stuff from the box, this time. I went upstairs to see Gordon.

I found him bent over his microscope. "Ah, you're back. Progress?"

"She's coming in an ambulance," I told him. Then I outlined the legal situation. "I don't think they can touch you, but if things go wrong it could be messy."

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"I will keep my records in order." His notebook was open beside the microscope, with a ballpoint lying in the crease. "Good intentions not enough, eh?"

"Not when lawyers are involved. And they do get involved."

He was peering down into his microscope. Without lifting his head, he picked up the pen and wrote in his book. "No respect for fact or justice. Kill them all," he said, wolfishly grinning. "No. On second thought, kill one in ten. To encourage the others."

It wasn't a useful line of discussion. "So far, what have you got?" I asked.

"So far? Almost nothing, to tell the truth. Rat B-3 I think it is . . ." He consulted his notebook. "Yes, B-3 has shown a low red cell count. Unfortunately I do not have one from before its exposure so I do not know if it's significant. Otherwise, I have no negative findings. Had we more time . . ."

"We don't," I said.

"Exactly. At present, I cannot say the procedure is safe. Neither do I have information that indicates it is not."

"If we do nothing, she'll die," I said. I was thinking aloud now. "How much damage the radiation has done to her already, we don't know, nor do we know that this process will do no harm. It's possible she'll die no matter what we do. Have I covered everything?"

"It could kill her in a year, instead of the seven days the cesium would take," Gordon said. "From what I've seen, I suspect there's some effect on the chemistry of complex molecules. Unpredictable, that. Or brain damage. There is always that possibility."

"How much brain damage?" I asked, knowing he didn't know.

Gordon displayed open hands. "I am speaking of possibilities." He leaned back in his chair. "I think, in his present circumstance, we must hope the horse will learn to sing hymns."

"What?"

"Oh, sorry. One of the impediments of a classical education. Makes communication difficult at times. I am saying we must proceed with hope for the best. Fair enough?"

I had no more than I'd had before. From Gordon, what else could I expect? I turned to go.

"I'll continue up here," he said. "If I find something definite I'll be down at once with flags aloft. When they're ready to . . . You'll call me, won't you? Wouldn't care being left to fiddle while you burn Rome, you know."

I'd have preferred a less apocalyptic metaphor, but I mumbled a promise and went back down.

The crowd in the workroom had more than doubled. B.J. was there with Morton. Also Mr. Templar from the hospital with the lawyer and, I was surprised to see, Dr. Fortescue. "Purely an observer," he explained to my upraised brow. "If, in spite of my doubts, the procedure shows merit, I shall want to know all I can." Hanging in the background, I noticed several other men who looked new. No one introduced them, and I was distracted from asking because just then the ambulance arrived. Things started to happen.

I sent Terry upstairs to tell Gordon. Hardly a minute later both trooped down. The ambulance was backing to

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8 the loading dock where Mark was making wigwag guide signs for the driver. Cold air reached us through the open doors.

Dr. Fortescue saw Gordon, somehow diagnosed his identity, and approached. Long, loping strides.

"Did you take the brain sections I suggested? The enzyme tests?"

"Certainly did, thank you. All negative. No contraindications, that is. Of course, with so little time . . ."

Looking three ways at once, Hal come over. "Did you give her the sedative?" he asked.

"What?" Intent on Gordon, he hadn't noticed Hal. "Oh, certainly. I ordered the medication and saw it administered. I agree, she could be kept as motionless as possible." With another thought, he hesitated. "That is a private judgment, you understand. I am presently resigned from this case."

"Huh? Oh, sure. It's just that I . . ." Already he was hurrying off toward the loading dock, where now the rear door of the ambulance was being opened.

Dr. Fortescue turned back to Gordon. "What about reflexes?"

Still another unfamiliar face hove past, distracting me, and someone put a warm plastic cup in my hand. Coffee. I'd been neglecting that duty. "Sandwich? Ham? Ham and cheese? Tuna salad?" With a slice of pizza in one hand and the coffee in the other, I was fairly hobbled but succeeded in balancing the sandwich on top of the coffee and mumbled a thank you. If memory serves, it was chunky peanut butter and jelly on rye; I could be wrong about that.

Out at the loading dock the ambulance crew was struggling to get the loaded gurney out. There should be a better way to handle that business; I made a mental note to speak with our design people. Perhaps new features on the gurney, or a power lift, or body panels on the ambulance that open like a beetle's carapace . . .

Errin Hobart was wrapped in a blanket. The breathing mask covered most of her face, her eyes were closed, and the cowl came down over her forehead. Later, I noticed her eyebrows were gone. Fallen out? Shaved? Three red flecks stood clear where the left one had been.

With a grunt and heave they raised the gurney up to the loading dock and then Hal was helping them trundle it over snaking electrical cables toward his machine. The crew included a nurse and two paras who worked smoothly together, as if with single mind. Mark cleared a path through the maze of onlookers, laid down tools, the video camera, and the sheet steel screens. When they had the gurney positioned beside the Teflon platform, they exchanged glances and, with almost formal stiffness, stepped back.

"All yours, pal," one of the paras announced. He meant Hal.

"Before anything further is done," Dr. Fortescue announced, voice sharply clear; everyone's attention was caught. "I want it known that on legal advice I have withdrawn from this case. I will accept no responsibility for the procedure now to be attempted. In fact, I have recommended against it. I am here only as a potential future witness."

When he stopped talking, you could have heard a mouse on tiptoe. Then Mr.

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Templar stepped forward. "Speaking for myself and representing DeVore Healthcare Center, I must say that we also disclaim responsibility for anything that may have happened to this unfortunate young lady since her release from our facility. She was released at her request and against our advice. Thank you for your attention."

Then it was a para's turn. "Shiawassee Valley Ambulance Service says the same thing. We brung her here, standard transport order, but that's all. OK?"

"If we're done with the CYA announcements . . ." B.J.'s voice harrumphed. He got no further before Morton caught his arm. While they argued in whispers, still another voice came up.

"As an authorized representative of the . . ." It was one of the strangers, and I realized with alarm that his off the rack suit and fluffy manner spoke of petty officialdom. Mark, though, was faster than I.

"Aww . . ." he said and put himself in front of the man like a thundercloud blocking the sun. "We don't want to bother a guy that's doing honest work, now do we?" A hand roughly the size of a rack of beef clambed on a polyester shoulder and backed its owner toward the deepest corner of the shop. "Let's just go sit down and watch the show, huh?"

All at once we had silence again. Hal was between the gurney and the Teflon platform, no one else near. He looked around, and I thought of animals caught in spotlights. "Mr. Truscott?" he asked.

"Go for it, son," B.J. said.

No way to go but forward. He turned to the gurney, stripped the blanket away and lifted her out with the care of a father for a newborn child. Her smallness startled me, and her pallor. Under the blanket she wore only the standard, useless hospital gown which, as usual, failed to behave itself. The deep, hollow scar in her thigh—as if the dog had ripped a chunk out—made me catch my breath. He let her down gently onto the table, straightened the gown, and made a pillow out of a handful of rags. Hesitating, he retrieved the blanket and tucked it around her.

For a moment then he stood still, meditating. I became aware of someone talking close to me.

". . . feels guilty about jilting her, and . . ." she was saying to the neatly-dressed man who faced her under the gaze of a video camera.

Was this to be made into a soap opera? Not if I could help it. "Excuse me," I intruded. "I don't think it's that at all."

Mrs. ex-Hobart glared; I stood my ground.

"Then what?" asked the neatly-dressed man.

I noticed, possibly too late, the "See Three" logo of channel three under the camera's lens, and recognized beside it Waldo Martindale, our media relations veep, making desperate, incomprehensible motions with his hands. "I'd prefer not to speculate," I said. "If, later, he feels like telling—"

"And who are you?" See Three's man-on-camera wanted to know.

I realized I must have looked rather disheveled, just then. Not recently shaved, shirtsleeves and filthy trousers. "No one important," I said. "He, over there, is the only one who is."

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Over there, Hal was having difficulty rolling the Teflon platform into the magnet cavity. Though originally made large enough for a person, that was before Hal's modifications. Those terra cotta drainpipes made a close fit even for a person so small.

"Need a hand?" Terry came forward.

Hal waved him back, but then with a sudden thought gestured to the gurney. Steel, almost certainly. Terry wheeled it away while Hal removed the blanket and tossed it aside. Now the platform went in smoothly. In a moment, even her bare feet were out of sight. He tested to be sure it was notched in place, checked the superconductor's temperature reading, scanned around. Then he stepped back and turned.

"Everybody, all of you, you'd better stay behind that screen here." No one else was making a sound. "Uh, won't be much to see, but if you want we've put a mirror over there." He nodded that way; it was bigger than the one I'd seen earlier, borrowed, I later discovered, from the ladies' room in the front building.

"Oh, and if anybody's got a pacemaker or a hearing aid . . . well, anything electronic, better get as far back as you can. Supposed to be safe outside of ten or fifteen meters, but that's before we changed a lot of things." Nervously, he looked around. "Uh, guess that's everything."

We were all moving back, though what the hazard was I wasn't sure — hadn't we been through that?—and the men with the video cameras were bustling and muttering querulously among themselves. Who some of these people were I couldn't imagine, but dutifully I initialed for another consignment of pizzas, reflecting as I scrawled that perhaps this was how that business of loaves and fishes was done.

B.J. snatched the customer's copy from my fingers and, when I drew breath to protest, gave me that special glare he reserves for occasions when argument will not be tolerated. "*Our* party," he growled.

I stood sipping a very welcome lemonade, having found a place where the mirror permitted a good view. Gordon was there at my shoulder.

"Moment of truth, eh?" he said. Someone laid a warm slice of pizza in his hand. "Thank you," he said automatically. Then, puzzled, "What *is* this goo?"

"Try it," I suggested. "It's actually very good."

"Seems an auspicious moment for new things, let us hope. *Murfle*. Mmmm. Interesting!"

"Let us hope," I murmured. "Yes."

Hal waited until all had taken refuge. Standing in the opening at the end of the screen, he looked back one more time—I thought of Orpheus—then took position at the pulse generator.

"Ready?" I don't know who he was asking

"All yours, son," B.J. said. Hal nodded absently, moistened his lips with the tip of his tongue and possibly murmured something as he thumbed the button. Aside from the flicker of lights on the panel and the undulant hum of the magnets, it was the same nonevent as before. Knowing better, still I'd expected more; I think we all did. Hal crimped a corner of his mouth and

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clenched a fist. Myself, I did not dare breathe.

The humming stopped. The lights on the panel ceased their dance. Hal snapped a circuit breaker and crossed the space to the machine so quickly I expected a thunderclap. He grabbed the platform. Terry advanced to help hold it steady.

It rolled out smooth and easy. One squeaking wheel. I felt a terrible urge to go help, but knew I must not. I spread arms wide to hold back others. Someone had to. Breathless, I saw the sleeping girl breathe.

Dr. Fortescue brushed past my hand. One stride into the arena, he paused. "May I examine?"

For a heartbeat's interval, I thought Hal would politely invite him to contort himself. Instead he nodded. "You'd know what's important; I don't. Last thing I want is to hurt her."

"Late for that," said Dr. Fortescue, dragging a stethoscope from his pocket as he advanced.

"Means and ends, sir," Hal said, ill at ease. He took the geiger Terry brought without a word, waved the wand as if in hope it would do magic.

Dr. Fortescue adjusted the stethoscope in his ears. "Young man, I understand completely." He bent to listen to her heart.

Hal's hand paused. "I'm not sure you do," he said.

Ignoring him now, intent, Dr. Fortescue found a wrist.

Hal went around to the platform's other side to allow Dr. Fortescue unhampered space. The geiger's wand he trailed over her as he moved. It made no sound.

At her feet, he set the box down, made careful adjustments and resumed. Slowly, swinging the wand side to side, he worked upward. It stayed silent. Dr. Fortescue borrowed a blood pressure cuff from the ambulance nurse. The quiet business dragged on. All I heard was the whisper of blood in my ears.

Hal touched the wand to her breathing mask. Not a sound. He passed it close to her brow. No alarm. Drawing back, he mumbled apology as Dr. Fortescue carefully peeled back an eyelid. They exchanged glances but no words.

Gordon touched my arm, made a request with an arched brow. I let him pass. This business needed an impartial judge. One of the video cameras crowded forward. I made it stay.

Hal removed her breathing mask to let the geiger sniff inside. Dr. Fortescue took the opportunity to put a thermometer into her mouth, shifting its sensor tip until he had several readings. Hal touched the wand to her lips and then her nose and held it there until she had exhaled all the way and begun to breathe in again. Gordon moved behind him, peered at the geiger's readouts, said nothing. Hal lifted his eyes to the doctor.

"Negative readings, sir," he said. "No radiation. Zero."

"It's not working," Dr. Fortescue said.

Hal checked the switch. "It's on." He snapped it one way, then the other. The little amber light winked and came back on. "See?"

"Then it's something else. The battery?"

But the piplight shone. From where I stood, I could see it myself.

"Something is definitely wrong.

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There's background. Even if there's nothing else, always there's background."

Hal rechecked. "Set to its highest sensitivity, sir. Is she all right?"

"No significant change in her condition," Dr. Fortescue said with careful specification. "Too early, of course, but no immediate trauma. Slight drop in temperature, which we can assign to ambient conditions." He nodded down to where she lay between them; the hospital gown left her legs, shoulders, and arms bare. The dog-bite scar seemed a cruel violation.

"It's working, sir," Hal said. "Here, I'll show . . ."

Taking a step toward the workbench where the box of contaminated specimens sat, he turned. As he turned, the geiger bipped. Just once, but in that hush no thunderstroke could have alarmed us more. Hal froze, his face a mask of dismay.

No one spoke. Slowly, dumbly Hal reversed his movement. The geiger's wand was in his hand, the carrying handle of its box in the other. The wand was not, I realized, pointed at the girl. Nor, I was almost sure, had it been.

"Cosmic ray?" Hal wondered aloud.

"Possibly," Dr. Fortescue said. From his tone, he was skeptical.

"But that means it's . . ." Hal was starting to say. The geiger bipped, interrupting him. He looked down at the wand. It pointed directly at the doctor.

He moved it closer, and it bipped again. Carefully, he swung it side to side, advancing it an inch or two with each pass. On the fourth pass it bipped twice in quick succession. When it did that Hal zeroed it to the doctor's tie clasp. "Beep," it said. "Beep beep beeee . . ."

Dr. Fortescue's clasp was gold with a decorative stone set into it. With the geiger Hal searched its length. When he came to the stone the beeping became nearly continuous.

Dr. Fortescue, aghast, snatched the clasp off his shirt and would, I think, have hurled it as far as he could. Hal offered a hand for it. "We could make it safe, if you'd like."

"Worn it for years," the doctor said, shocked horror in his throat. Radiologists, I remembered, avoid needless exposure the way most of us shy from blazing blue electric wires.

By then, I think, not one of us had failed to grasp what we had seen. Hal had his dragon. Gordon's though, was the voice to proclaim it, triumphantly bold in the silence.

"And gentlemen who lie abed in England now," he boomed, "shall think themselves accursed they were not here!"

Close to my ear came a gasp and then excited yells exploded all around. I'm sure it was then that the coffee got spilled on my trousers, possibly from my own cup except I'm nearly positive I held an empty lemonade container at the time. And that blizzard of Frisbee-tossed pizza cartons that I'm sure you saw on network news. All I noticed at the time was a sense of universal tremendous gladness. I don't know who I hugged, or who hugged me. If drinks were spilled, as Gordon later remarked, I should consider it merely a belated offering to the gods.

I found myself accepting another cup

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of coffee and declining a sandwich. Only when she moved to the person beside me did I realize it was Mrs. Truscott.

"What are you doing here?" I murmured.

"Should I be somewhere else?" she asked. "Joe told me on the phone. Somebody has to think about these things." Then she was off, pressing plastic foam cups into other hands that hardly noticed. Wonderful hostess.

Hal took off his glasses, rubbed his eyes. Something wilted in the way he stood, and his fingers fuddled the job of putting his glasses back on. "Will you . . ." He started to say, and only then located Dr. Fortescue in front of him. "Can she be your patient again?"

Dr. Fortescue stood silent so long I wondered if he had heard.

"Please?" Suddenly Hal was helpless. "Sir, all I could do was stop it. I . . . I don't know how much harm it's done."

Dr. Fortescue offered his hand and a smile. "An honor," he said. "Doctor."

I remember only bits and snatches of the time that followed. Hal stayed close while the ambulance people transferred her back onto the gurney and followed as they wheeled it to the loading dock. He leaned against the freight door while they loaded her aboard. Quietly, neither lights nor siren, it grummed away. He stayed in the doorway a moment longer, breathing the night's chill, then stumbled back inside. After that I lost track, and if I thought at all, I thought he must have gone after the ambulance with some vague thought of claiming his romantic soul's reward. Young Lochinvar. Lord, I hoped not.

While I tried to remember how I'd got fragments of peanut between my teeth, B.J. was accepting cards and scribbled forms from various strangers I'd seen hovering about. One was from the FDA, and a pair from NRC and others from the DOE and NIH, OSHA, EPA, and every other assemblage of random alphabet I could imagine. One may have been CIA, but we've never been sure. Also an executive from Gas & Light grinning ear to ear and shaking hands as if it had all been his doing.

The petty official Mark had rendered *hors de combat* presented a lengthy sheet of paper, mumbling something about, ". . . have to hold an inquiry . . . informed when it's scheduled, but . . . Shucks man! Don't worry about it. Won't dare do anything bad." He shook his head. "Oh, what a limb to be out on!"

"Comes with the territory," B.J. rumbled. "We stand by our people and what we produce."

The video camera was watching, I noticed, and See Three's on-camera man standing fidgety tiptoe ready to move in if things got dull; and Waldo Martindale, his face all smiles, quietly feeding information into that one's ear. Everyone loves a winner.

Others in the crowd around B.J. were saying things like, "Call us first thing Monday," and "Schedule a demonstration," and "When can we expect to hear?" B.J. was nodding, putting up a fine front, but starting to look worn. Morton was taking the papers as fast as they came and scrawling quick notes on the back.

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I got B.J. aside. "Hadn't we better call the insurance people?"

B.J. scowled. "What for?"

I started babbling something about how they'd want to know how things came out. Certainly, in their shoes, I'd have wanted to.

B.J. stopped me with a grin and a grip on the arm. "Nevvie, what they don't know won't hurt. When they see it in the papers, they'll scream."

"But . . . not at all?"

"Should I have? Give 'em a chance to say, 'don't dare'?"

I had to stop and think, something of an effort at that hour. "Wasn't it a risk? They might . . ."

He gave me a weary smile and his usual direct eye. "Nevvie, I quit thinking business eight hours ago. Time you did."

Everywhere I looked there was litter. Pizza cartons and plastic foam cups and sandwich wrappings. Our crowd was beginning to thin, the men with the cameras buttoning up their equipment and trooping out to their van. Our security people were trying to help, and Waldo followed with one last thought for the ear of the on-camera man. Efficiently and without fuss the Gas & Light crew was disconnecting the temporary cable and rolling it up. I spoke to their foreman. "Terribly grateful to you."

He paused, grinned an *aw shucks*, and touched the rim of his plastic hat. "Wouldn't a' missed it for the world. Tell m' grandchildren."

I made a mental note. An official letter of thanks would not be out of place. Yes, and to those people who had kept us in pizza; I looked about, but their driver was gone. An executive's work is never done.

Hal also had vanished. I encountered Gordon on the stairs, Burberry buttoned and trilby perched proud. I caught his sleeve. "Could not have done it without you," I said.

He stopped. "Pshaw. Should I have stayed home with my book?" With a gesture he answered that. "What that blessed dog did in the nighttime, does it matter? Whereas we . . ." A shrug and a satisfied smile. "We few, we happy few." With the door open, letting in the chill, he paused with a new thought. "But suppose. What if Peter had *not* caught the wolf? What then?"

On abrupt feet he strode out into what remained of the night, robustly chant-singing:

Freude, schöner Götterfunken,
Tochter aus Elysium,
Wir betreten feuertrunken,
Himmlische, dein Heiligtum.

The glum-faced cleanup man was in the shop, methodically checking the specimens off a list and dropping them back in the box. Mark and Terry were there, too, trying to pick up some of the mess. "Leave that," I told them. "Go home. Get some sleep." I needed some myself. My watch said, 4:30. Could Hal's apparatus have stopped it? "Take tomorrow off."

Terry looked at me incredulous. "Mr. Norway, it's Saturday."

I blinked. Was it possible? Had I come so completely adrift?

Apparently I had.

When everyone had gone, I stumped around turning off lights, made sure our coffee maker was unplugged, computer

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terminals safely shut down, all the petty routine details. I felt good, comfortable, and satisfied with myself. All I wanted now was home and sleep.

I found Hal in his work space, curled up behind the desk, something more than two-thirds asleep. For a moment I considered leaving him, but thought again and woke him.

"I'll get you home," I said.

Not until I drove out the gate—where the usually sleepy guard waved a jubilant high five—did another thought came. "Would you rather, the hospital?"

"What for?" he asked.

Feeling the crunch of metaphorical eggshell underfoot, I turned onto the street. "Shouldn't you be there when she wakes? She'll want to thank you, I would think."

He was so quiet I thought he might have fallen asleep. But then he said, "You don't understand." Then quiet. Then, "Doesn't want to see me again."

I must say that took me by surprise. "But surely—"

"Listen," he said, the words crisp. "You wake up, middle of the night, and you know how to do it. Do you just turn over and go back to sleep?"

And after a moment, "Anything else is *my* problem."

I suppose I mumbled something. The rest of our drive across town passed in silence, each of us with our own thoughts. Perhaps Hal slept, but when I looked across to him he was sitting ramrod straight, eyes open, mouth pressed to a thin, bloodless line.

Of course that's not the end of the story.

The next week, Thursday it must have been, she walked into my office and sat down in one of the visitors' chair before I could so much as nod. She was pale and appeared to have recently lost weight, and her hair—what I could see—was a fuzzy stubble under her scarf. Thin arms. Her face would never be *beautiful* by the standard definitions; a chin too small and a nose too blunt and slightly too long, though it's amazing what young women can do with a touch of eye shadow. And she did have startling eyes. Her eyebrows were lines painted on. I knew her by the small pinprick scabs which the brow mark didn't quite hide; that and the "Recovering Nicely" newspaper photo we'd all seen, she sitting up and gravely sniffing one of the roses Mrs. Truscott had sent, and that ocean of other bouquets all around.

"Not supposed to be out; the nurses smuggled me," she said, wickedly proud of herself, then switched channels. "They say you're hiding him. Where?"

A miserable, drizzly rain was coming down outside, but only a few drops had touched the hospital scrub she was wearing; loose top and pants so oversized she could have been a wraith inside. One of those plastic identification bands circled a wrist no thicker than a twig. Not having expected her, I was slow adding up two and two.

"Hal?" I asked, as much to gain time as to confirm the obvious. "I've not seen *him*."

That was absolute truth. He'd neither come in nor phoned, and things had been piling up. Both the general and technical press were besieging Waldo for interviews. Hamilton Hammond

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wanted information for the patent applications, our accounting and warehouse inventory control departments were trying to untangle the shambles we'd left, approximately a dozen government agencies wanted to know which regulations we'd bent, and a thousand laboratories and industrial facilities wanted to know how soon our apparatus would go on the market. Also, somewhere in my stack of paper, was a letter from the president of the pizza chain, so overjoyed by the sight of all those highly recognizable cartons tossed like confetti on network news that corporate headquarters insisted on cancelling the bill.

We few. We happy few.

As for that letter asking me to go speak about employee motivation, that had to be someone's idea of a joke.

Hal, meanwhile, wasn't anywhere. The weekend newspapers, if you remember, spoke of a team of scientists under my direction rushing a long-term project to completion under the spur of necessity. On the tube, his youth, his disheveled look, and his T-shirt and jeans had branded him indelibly as a mere technician. Not until Monday did we get all that straightened out. By then, Hal had vanished. He was not here, and his apartment manager, grumbling about journalists, reported him gone. After several hours of nonappearance, Waldo instructed our front switchboard to tell callers he was exhausted, emotionally and physically, and was resting in seclusion. Not, please note, an incorrect statement. Meanwhile, Waldo haunted us for word.

That was Monday. By Thursday, when Errin came, all evasions had worn thin.

"I'd like to find him myself," I told her.

"I've got to talk to him," she said. Her tiny hands were fists in her lap and the corners of her mouth were tugged back. And those blue eyes. "Got to."

I leaned back, wondering what I should say. Perhaps nothing. Above all I wanted to do no harm and I could sense that things were fragile. "He said something about you didn't want to," I said as mild and offhand as I could. I was not prepared for the look of pain that came to her eyes.

"I . . ." Now she wouldn't look at me. "It doesn't matter he didn't send flowers. But do you think they don't have television in the hospital? And that awful creature from the newspaper! Do you think I didn't know, from the minute they. . . ?"

I may have murmured something. I may have stayed silent. She was pouring out every thought in her head and no words from me would stop the flood.

"I had this silly idea," she said. "Oh, I know where it came from! First they say they love you, then they hurt you. I didn't want that again." That much came out, then she stopped. I waited.

"I talked to the nurses," she said. "No. That's not true. They talked to me. Young ones and old ones. They said—well, never mind what they said. But they told me . . . Dumb. Stupid. Dumb. Dumb. Stupid."

I sat there wondering, why me; had I asked for this to turn up in my basket? And what could I possibly say? The care and feeding of creative people is one

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thing; this, quite another. For my ego's sake, I wish I could say that with a few inspired words I—as it were—kissed and made well years of bad luck.

The truth is more pedestrian. I glimpsed movement in the doorway. On good carpet, not a sound.

"Won't take a minute," Hal said, hardly more than a mumble. He had a piece of paper in his hand, folded. "I know I got you in trouble and the company in trouble and I made a mess of things. I . . . Mr. Norway . . ." He reached past her shoulder.

She twisted in the chair. "Hal!" She stood up. Turning, she lost her balance, fell against him.

Automatically he steadied her. "What are you doing here?"

"Looking for you. Shouldn't I?"

"But you said—"

"Don't care what I said! Mother's an idiot!" By then her face was against his *Maxwell equations* T-shirt. Her scarf fell off; at some point her scalp had been shaved.

I got up from my desk and quietly walked outside. I closed the door. I don't think they noticed.

He'd been back in his work space. Marta hadn't told me.

"You were talking to Waldo on the phone," she said. "I thought it would be a good idea." She nodded toward the corridor.

Yes. Letting Waldo know he'd appeared would have been a bad move; Waldo, with his obligations to the channels of publicity, already passing back to us the mutter that, for reasons of our own, we were keeping Hal under wraps. Not until we'd assessed things ourselves dared we let Waldo have him.

"But that was an hour ago," I puzzled.

Marta did not waver from my gaze. "Thought he needed time to get his head on straight."

Had she known his thoughts? The piece of paper had only a few lines, badly typed:

Dear Mr. Norway:

For personal reasons I must ask to be released from my employment contract effective this date. I will pay for the things I took and used, and all the other costs I put you to as soon as I am able.

With deep apology,

HAROLD KENNEY

How, I wondered, could a man so brilliant be so blind?

". . . And when she zipped past me, supersonic-like . . ." Marta went on.

I stopped her. "Perfectly handled. Could not have done better myself."

"Of course not," Marta said.

Some day, Waldo may forgive me for not giving him a buzz. Unrepentant, I'm still waiting.

The person I did call, using Marta's phone, was Frank Delbanco in Security. He stopped my lugubrious explanation after approximately three words. "You think I don't know who comes through that gate? You think I don't know who's camped across the street? Comp'ny limo's got sunscreen glass. Where they going?"

I had not thought that far. "His place. Hers." I shrugged. "The airport. Paris. Possibly the Mountains of the Moon."

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"My most reliable man will be right over," Frank said. "Me."

How long they stayed in my office I will never tell. What was said was between their ears alone. When they came out, she was in the shelter of his arm. From their faces we knew things were fine and the world was a wonderful place.

". . . *not* because . . ." she was saying.

". . . but they'll think . . ."

"Don't *care* what they think!"

"Got your car right outside, folks," Frank said.

I stopped Hal long enough to give him the letter. "We'll talk about this some other time," I said in my most managerial tone. "When you don't have more important things on your mind."

He mumbled something and shoved it into a pocket, hardly aware what it was or what he was doing.

Frank led them down the stairs.

". . . hospital before they miss you," Hal was saying. "Still sick . . ."

". . . be all right," she said. Not troubled now. "And I want to find where father went, and . . ."

"They took your pretty hair," he said. That hurt.

"It'll grow back." Not a care in the world.

I suppose there will always be dragons. Therefore, also, young knights to slay them. The weapons may not be lance and sword, these days. The armor may not shine in the sun. Unimportant details. The battle still is desperate and, yes, sometimes the dragon wins.

That dragon, though, not ever again. The world has become a more comfortable place. All things seem possible. The ripples flow outward.

Hal stayed on our payroll another year and a half, a gloriously creative time. Then, before we had any idea, the patent royalties flooded in. Taken by surprise, we paused for breath, and B.J. summoned us up front. New arrangements seemed imperative.

It helped that B.J. is a greedless, honorable man, and that Hal cares nothing for day-to-day business. While the lawyers haggled over dotted i's, he cheerfully ceded the joys of bean counting and management, the legal and licensing powers which justify the company's percentage of the income. Hal, for his part, has freedom to think, to tinker and experiment, or simply to raise his growing family, all without the concerns besetting us commonplace humans.

A condition, I would say, he has completely earned.

Nor has he stopped thinking his long thoughts. A few weeks ago I watched his latest apparatus lift itself off a well-tended lawn, using neither jets nor rotors to suspend itself. Proof of principle, he says with a shrug. Not efficient, and so long as it needs that thick cable for power . . .

What next, I wonder.

So, yes, I see him frequently. Sometimes he needs to use our equipment or have something built, or he wants to put heads together with our people, or consult with our production staff.

Sometimes though, when Errin needs another treatment, they bring the children. Bright, healthy children, the hope

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of the world. They call me uncle. Little Becca, the youngest, with her mother's eyes and yellow hair, sits on my lap. I talk to them about dragons. ■

Classifieds Continued

(continued from page 252)

BOTHERED BY gargantuan pests? Under attack by vast military forces? Has a creeping fungus covered the surface of your planet? Then write Sam the Exterminator. References: the Crab Nebula, the Horsehead Nebula, the Epsilon Eridani asteroid belt. When *I* exterminate 'em, they *stay* exterminated! Box 1014.

CLASSIFIED ADS WRIT CHEAP. SEE CURRENT *ANALOG* FOR EXAMPLES. CONTACT MIKE RESNICK.

FOR SALE:

FAMILY STARSHIP, clean, like new, air-conditioned, nuclear-fueled, only 60,000 parsecs. 27,500 credits, or will consider trading for vacation home on *methane world*.

MARKED DOWN: 25 model XB-227 robots—loyal, brave, hard-working, minor cosmetic dents and scratches will not impair operation. 60% off list. (Self-preservation chip will be mailed free of charge when available.) Joe's Cut-Rate Robots, Box 72.

SLAVE-TRADING business for sale. Includes all equipment, property, established oxygen-world routes, goodwill. Contact Honest Thyrrp's Interstellar Job Placement Service, Box 10101.

EXOSKELETON, sixteen legs, four eyes, powerful mandibles, hardly used. Available when metamorphosis is complete. Contact Plindro the Lyoptian, third tree on the left.

Make that 19 robots. Price reduced 65%. Joe's Cut-Rate Robots, Box 72.

ANNOUNCEMENTS:

BORN. To Diliophiatre and Mangaresk of Tau Ceti XIII: 3,622 males, 4,015 females, and 12,064 *glymphs*. Congratulations from the Acme Diaper Company.

BORN AGAIN. The Reverend Billy-Bob Watson, of North Spittoon, Arkansas.

DIED: Blaniph Ortch, beloved husband of Hvata, Mchee, and Kryngh. Of congenital botanical allergies. (No flowers, please.)

IN loving memory of Htormm, who would almost certainly have made a compassionate and loving lifemate if I hadn't basted, baked and eaten him first. Ktimmm.

MASS BAPTISM CEREMONY: The entire population of North Spittoon, Arkansas. Y'all come. Or else.

PERSONAL:

LONELY but loving *gromorf* seeks *jhaitan, rxtyl, ymotti*, and *bxteryl*. Object: matrimony.

BLONDE human female. Heavily into leather, orgies, bondage/discipline sadism/masochism, French, Greek, Arcturan, Altairian, Castorian, seeks unencumbered, fun-loving, oxygen-breathing male gentlebeing with similar tastes. (Positively no freaks.) Box 69.

TO Galactic Robots, Inc.: Where the hell are those chips? Contact Joe's Cut-Rate Robots A.S.A.P.

YEBI, come back—all is forgiven. I know you didn't mean to gnarlf the platookta. Your loving Xumi.

RESPONSIBLE for my wars only. Cjsonti The Destroyer.

ALDEBARANIAN salesman seeks Mazirite *kloopf* for symbiosis during long business trips to Sirius. Blood specimens and skin scrapings required. Box 725.

50,000 CREDITS reward offered for the head of Yebi. Contact the PLO (Platookta League of Orion), Box 1076.

FOR SALE (addendum):

Make that 14 robots, and they're now 70% off list. Reply soonest. Joe's Cut-Rate Robots, Box 72.

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the reference library

By Tom Easton

Down the Bright Way, Robert Reed, Bantam, $?, ? pp.
The Madness Season, C. S. Friedman, DAW, $4.95, 495 pp.
Shivering World, Kathy Tyer, Bantam, $4.50, ? pp.
Days of Atonement, Walter Jon Williams, TOR, $19.95, 437 pp.
Synners, Pat Cadigan, Bantam, $4.95, 435 pp.
Hero! Dave Duncan, Ballantine/Del Rey, $?, ? pp.
Hypertales and Metafictions, Bruce Boston, Chris Drumm Books (P. O. Box 445, Polk City, Iowa 50226), $4.00 ($7.00 signed, with *Other Voices—Other Worlds* cassette), 64 pp.
True Minds, Spider Robinson, Pulphouse (P. O. Box 1227, Eugene, OR 97440), $4.95 (trade paper), $25 (limited cloth), $50 (deluxe leather), 108 pp.
The Magic Machine, A. K. Dewdney, W. H. Freeman & Co., $15.95, 357 + xvii pp.
Books on Disk

Robert Reed has made himself a writer worth paying attention to. Remember *The Leeshore? Hormone Jungle? Black Milk?* He has a grand imagination with plenty of scope and sweep, he can plot more than well enough, and his characters are better than those of many another writer. All of this should make you perk up at the word that his fourth novel is now available. Perhaps you'll perk up even more if I say that **Down the Bright Way** does indeed live up to expectations, despite the occasional surfacing of some remarkable gobbledygook: "It is named for what we see when we travel upon it . . . the brilliant white light extending well beyond the visible range, in both directions, with the microwaves and radio waves and the hard radiations having that same characteristic whiteness . . . the Bright partly constructed from the screaming un-

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blinking chaos that is the entire spectrum . . ." (quoted from manuscript).[1]

The Bright Way of the title is a sort of highway across millions of alternate Earths, apparently constructed by some long-gone race of Makers. It was discovered some *millions of years ago* by variant humans (rather monkey-like) known as the Founders. One of that race, Jy, convinced her fellows that the discovery bestowed upon them a divinely mandated destiny: Follow the Bright Way, seeking the Makers and doing their best to give all the human kinds they find along the way peace, prosperity, and a place in the mission if they so desire it.

Now the Wanderers have reached Earth, and they are having much the impact you might expect. Some of the local folks, such as Kyle, are so impressed that they learn all they can of the Wanderers' history and lore, wear the grey Wanderer uniform, and pass themselves off as Wanderers among their own kind. Alas, Kyle picks up a girl friend, Billie, who would just *love* to meet the Wanderer leader, Jy (yes, *that* Jy), who will be holding a rally shortly. Could Kyle please. . . ? And of course the chump can't find any graceful way to weasel out of that one. He agrees to take her to the rally and introduce her to Jy. Meanwhile, a mysterious figure called Molisk, apparently a Wanderer, is collecting an old crony—one (from that humanity known as Termites for their hive existence) who, when fed enough, can metabolize and act blindingly fast—and plotting an ominous attack on Jy and her entourage.

Can you guess the rest? Of course Kyle and his girl are with Jy when Molisk strikes and kidnaps them all. They thus provide a "local" viewpoint, one with which readers from this Earth and this time can identify. Unfortunately, they provide very little else, for they are *powerless*. The Wanderers hold all the technological cards, they know all the secrets, and one of our ignorant, backward selves can hardly hope to act with any effect on their stage. That may be realistic, but it rather undercuts the apparent point of using Kyle and Billie at all.

The real story is Molisk's, for once upon a time, we eventually learn, he was Jy's co-equal, just as idealistic, just as bent on destiny and spreading peace, prosperity, and enlightenment. He it was who led the Great March in the other direction from the Founders's homeworld, but where Jy met always human variants with whom the Wanderers could deal, he found . . .

I should say no more. Reed's novel is not perfect, but it is quite readable enough, and its point, that good, if it takes up evil's own weapons in the battle, can become indistinguishable from its foe, is one well worth considering. All who face this issue must confront the same question: How can you fight determined, voracious evil (e.g., Hitler, Idi Amin. . . .) except in its own terms? Passive resistance, after all, is useless against one who has no conscience. To survive at all, good must fight back, must do its utmost to destroy evil, no matter what the cost. Mustn't it?

Read the book for Reed's answer to that question.

C. S. Friedman's **The Madness Season** offers us a future in which the hive-minded Tyr have conquered Earth and, in order to preclude the possibility of rebellion, have shipped the best and

[1]Yes, I know, "white noise" is a mixture of frequencies, with none dominating. "White light" means something similar but the term is meaningless outside the visible spectrum. And speaking of the spectrum, doesn't it connote order far more than chaos?

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brightest minds off to be farmers or researchers on other worlds or even technicians on the Tyr's own ships. The rule, ringing a change on Caesar, is "conquer, then divide; slaughter only when the natives get uppity."

One of those natives is Daetrin. The Tyr realize that he has been around through all the centuries since the conquest, under many names but all too often in the guise of a teacher, passing on his memories of a past that the Tyr do not want their subjects recalling. They collect him, search him, and destroy the pills on which he relies for sustenance. Soon enough, the reader twigs: Daetrin is immortal because he is a vampire. To this Friedman adds a sensitivity to daylight, the ability to change shape, a vulnerability to memory, and a desperate need to fit in.

The scene shifts to a distant gas giant, where a Marra, a bodiless intelligence that can borrow or duplicate bodies at will, subsisting on the surplus life-energy of other beings, notes the arrival of a ship of the Saudar she once served. They have come at last, she thinks, to retrieve her from her mission of exploration and contact, and none too soon. Like Daetrin, she is immortal. Unlike him, her oldest memories fade into extinction; her identity, like that of a society (think of humans), is fixed by her most recent memories; to maintain identity past the limits of memory, she needs an embodied partner, an individual or, better, a society such as the Saudar. But the Saudar are gone, she learns, replaced by the Tyr.

Do you begin to gain some sense of where Friedman is going? She offers us two shape-changing vampires, both immortal. One remembers. One does not (except the relatively recent past). They are natural partners, and indeed it does not take Friedman long to put Daetrin, seriously injured by suspicious colonists, in the Marra's healing hands. Now they are together, prodded by circumstance toward resistance to the Tyr.

Enter the Tyr itself, or that fragment of the species known as the Raayat, the Unstable Ones. These are what pass for Tyr researchers, though they are prone to murderous rages. They crave knowledge. One becomes linked to Daetrin while he is a prisoner and learns something of the human mode of thinking. In due time, once Daetrin and the Marra have reached the deadly world on which humans do research ostensibly for the Tyr but surreptitiously for themselves and their hope of eventual freedom, he reappears. He also shows the very unTyr trait of individual consciousness and in his quest for knowledge actually aids the rebels. By story's end, this Raayat's individuality will play against the Tyr species' life cycle, and against what Friedman has said about the relationship of memory and identity, to promise a change in the very nature of the Tyr and perhaps a very different destiny for humanity and the other species the Tyr had subjugated.

Clearly, Friedman is up to something very interesting, even clever, and doing it pretty well. Unfortunately, I found myself wishing more than once that the tale would move a little faster. Friedman is not a lively writer. Worse yet, the whole tale collapses well before the end. In his millennia of life, Daetrin has forged a powerful habit of secrecy. He does *not* trust others. He does *not* tell his secrets. Now the Marra has drawn that trust and those secrets from him. And on the lab world, under what seems trivial provocation—even granting that, yes, his armor has been breached—he forgets how good he is at fending off probes with ingenious stories. He tells all. The rationale strikes me as having

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more to do with getting the story where Friedman wants it to go than with the nature of the character. And yes, it is very common for characters to act from their creators' agendas, not their own. It becomes a problem, as here, when it shatters the logic of the story and the reader's willing suspension of disbelief.

Or is it just me? Read it, and see.

Earth's a mess, what with chlorofluorocarbons having trashed the ozone layer (among other things). Genegineering is commonplace, at least for plants and animals; homogenegineering (of humans) is a strict taboo enforced by a Eugenics Boards that declares the products of gene transplants and redesigns, even fixes of genefects, nonhuman, sterilizes them, and walls them off in labor camps. The EB is bossed by Novia Brady-Phillips, a domineering religious fanatic. Her daughter, Graysha, suffers from a genetic defect that will kill her years short of the average span and quite naturally craves the gene fix her mother has banned, if not for herself then for her future children. She is also a microbiologist who has just been hired to assist the Gaean Terraforming Corporation (GTC) in making the world of Goddard habitable. Goddard's colonists are the Lwuites, a group that may be using religious-privacy claims to hide secret homogenegineering projects. Graysha hopes to gain the Lwuites's confidence for the sake of her future. But the colonists don't trust her—she has worked for the EB in the past, she's bound to tell her mother all, and maybe it's all an EB plot anyway.

This is the basic situation for Kathy Tyer's **Shivering World.** Add in a GTC management that sees Goddard as a black hole for money, a murder, the possibility of an ice age brought on by the inexplicable disappearance from the atmosphere of the chlorofluorocarbons being added for their greenhouse effect, a madman (and microbiologist) who lost all when his previous colony home was destroyed by a sudden climatic warming, a GTC prize offer for an airborne bacterium that can eat CFCs and save Earth, and a stowaway whose famous-musician father wants to pretty him up with just a little plastic surgery, and you have conflict enough to drive any two ordinary novels. The colonists try to kill Graysha. Graysha falls for one of the colony's leaders. The stowaway turns out to be fairly engaging. GTC management denies that Goddard's climate is cooling and tries to stop Graysha from looking for CFC-eating bacteria. Novia sneaks into the wings, rubs her hands, and chortles that Graysha got her job because Mama arranged it so, though she doesn't know it, and as soon as the evil Lwuites have repaired her little defect. . . . Heh, heh, and if she doesn't want to talk, Mama has these nifty drugs.

Parents! Here we have one who is a control freak in regard to his son. We have a second whose religious mania lets her feel that she has the right to extend the same ruthless attitude toward society as a whole. Tyer compares them both with the stowaway and his vicious pet, with colonists and their children, with leaders and their followers, with past and future, mortality and immortality, dreams and nightmares. And if what she comes up with is about what you might expect—there are nicer ways to treat your kids—getting there is a subtly tricksy journey with a good many rewards for the reader.

Could she have told the tale without the genetic engineering? Perhaps, but this technology does permit some intriguing extensions to the metaphors of control that we are accustomed to seeing

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in the stories we read. It also poses some intriguing, real problems (e.g., reactionary fanaticism) for future coping and raises such basic questions as "So what's so sacred about the human form anyway?" Is it okay for someone, like that famous musician, to sculpt and resculpt his large-scale flesh at will, and to impose the same thing on his son? Is it not okay to reshape the micro-scale flesh of the genes, even to repair clear defects? Granted that genegineering can be misused—such a case is what lies behind the EB's power—is that enough to justify banning the technology?

Walter Jon Williams *(Angel Station, Voice of the Whirlwind, Hardwired)* has done his best work to date in his latest novel, **Days of Atonement.** It's so good that you'll see it on the "Best of '91" prize ballots. You may well see it in the winner's circle.

What's it all about? Consider the old-time hard-boiled detective story in which the hero must deal with brutal, corrupt small-town cops who think the formalities of rules of evidence, suspects' rights, and trials only impede true justice. Their job is to make their towns "a nice place to live" as expeditiously as possible, and when a crime is committed, they almost always have a pretty good idea of who did it just because they know their townsfolk so well.

Just such a cop, the police chief of Atocha, New Mexico, is Williams' hero, Loren Hawn. When he catches a couple of local youth dragging a string of new-shot cats behind their car, he stops them and, when one reaches for the glove compartment, beats them to a pulp. A few minutes later, he finds that the compartment held a bribe, not a gun, but he figures they had it coming. When he catches a gang of robbers and drug dealers, he nearly kills the local boy who dared bring that kind of evil to Atocha. That one too had it coming.

Do you think you can't sympathize with a brutal thug cop like Loren Hawn? Don't fret. He's direct, physical, and traditional, yes, but less a brute and a thug than he may sound. He beats but never shoots, at least until near the very end. He loves family, town, and church and views crime as both insult and threat to all three. He agonizes as well over the social forces that threaten to change the world he knows. He is human.

What sort of place is Atocha? It's as human as Loren Hawn, a root place, an embodiment of rural bedrock stability. It has 41 churches, including Loren Hawn's own Apostles of Elohim and the Nazarene, who are observing the Days of Atonement for their sins this week. It's dry too, and the well water tastes awful, thanks to what the open-pit copper mine that has long dominated the area has done to the local aquifers. The graft from the local whorehouse and assorted other rackets was set so long ago that it is quite trivial by 21st-century standards, but graft it is. Politics is handled by a Democratic machine that has only lately suffered its first Republican reverse (by a mayor Loren once caught boffing a babysitter in his car; guess why Loren won't let his daughter work for the mayor's family?). The mining company is closing, laying off its workers, destroying the local economy. Advanced Technological Laboratories (ATL) has set up nearby to run a linear accelerator and do both classified and unclassified research. ATL's security forces, run by Bill Patience, an ex-Marine with delusions of glory, patrol the town as if looking for spies.

The drugs are designer drugs, but even so Atocha doesn't sound very science fictional, does it? But it does feel quite real. And when a man who died

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twenty years before in an auto accident crashes a car into a lamp-post outside the police station, staggers into the foyer, and dies in Loren Hawn's arms, we believe it.

Do we also, having grown so accustomed to the concept, suspect that Williams will solve the murder with a wave of the alternate-worlds magic wand? Admittedly, that's what it looks like as Loren identifies the crashed car as belonging to an ATL researcher, finds security barriers in his way, and collects such clues as a reference to vanishing energy in the accelerator experiments. But Williams has something else in mind, and he'll get to it just as soon as the Full-Blown Idiots offend the local cops with an unannounced raid on eco-terrorists. Patience and his henchmen destroy the local technological wonder, a maglev train, to kill two witnesses and then blow away Loren's screw-loose brother, and Loren gets mad. They're messin' with his town, and though the times may be a'changin', he's still gonna take care of things in the traditional way.

If you like bang-up endings, you'll love *Days of Atonement*.

Pat Cadigan's **Synners** is an intense, frenetic variation on the cyberpunk theme rooted in modern media obsessions. The root imagery is that of children who drop out of school, flee their families, and become street-wise hackers, creating from the newest of silicon technology marvelous videos and craving entree into the world of MTV fame and fortune. "Hotsuits" allow corporate creative types to create simulated dramas, and the public to live in those dramas as characters. Electronic implants control psychoses, mood, and mindstate. Viruses run rampant and threaten both computers and those who plug into the machines. Tattoo artists store complex programs and data on the hides of burned-out derelicts. And the corporate giant Diversifications has just taken over video maker EyeTraxx in order to gain control of a new technology that allows physical computer interfaces ("sockets") to be grown into people's brains, leaping the hotsuit approach to a dramatic new level of verisimilitude and user involvement.

The greedy, unprincipled moguls of Diversifications, who force premature legalization of the sockets, are the villains. The heroes are the hacker children, with Gina prominent among them. Gina's father Gabe works for Diversifications as a creator of everything from commercials to Hollywood spectaculars, though he has a tendency to spend too much time playing with his private simulations. Artie Fish (guess what he is?) dwells in the worldwide computer net and has a special relationship with the tattoo artist. And the viruses find in the sockets the path to social chaos.

Salvation lies with the world's innocents of street, net, and corporate rat-race, and there you have the essence of the tale. All the rest is ambiance, a post-quake, grid-locked California imbued with desperation, and a style that sometimes leaves the reader groping for some sense of what the hell is going on.

I enjoyed the book, but not as much as I would have liked to. The main problem is the heroic hacker kids, school dropouts and therefore uneducated but still technological miracle workers, every one of them. It's an attractive myth, but I believe that a myth is all it can be, especially when public education is on a downhill slide. Worse yet, it's a myth so overused—and dating well back into the dawn days of SF, long before cyberpunk—that it has the trite smell of overripe cheese.

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* * *

Dave Duncan writes that 1991 looks like a good year, what with all four books of a fantasy series coming out. Not only that, but his publisher has also scheduled, for May, an SF book he considers his best work yet. It's **Hero!** and it is indeed good. I doubt it will disappoint you.

The time is some thirty millennia in our future, long after humanity has spread far and wide across the galaxy. Interstellar travel is by slower-than-light Q ships. Those worlds in the neighborhood of the story's site are threatened by the gengineered Brotherhood. Members of the Brotherhood look human but have only twelve chromosomes (not 46), are almost identical, and are all male. They are grown in vats and therefore have no need of females. They are also intelligent, friendly, cooperative, cheerful, environmentally sane, altruistic within the group, and quite determined to dominate, in the name of natural selection, all the wild, untamed, random humans within their reach. They may be why the old worlds of the human "empire" have fallen silent.

The Brotherhood claims new worlds by sending immigrants who, once settled, build the necessary vats, multiply their numbers, and use their skills to achieve positions of influence. In due time, they take over. If they must, they plant embryos in local wombs and let them be reared to adulthood and acceptance by the locals. One such "cuckoo" is Vaun. Persecuted as a child for his obvious differences, he is in time caught, studied, enlisted in the Patrol, and used to fight off invasion. He becomes the hero of the title and is exploited for decades as a PR bonanza. And then he gets wind of another Brotherhood plot, finds signs that the Brotherhood remains on Ult, in hiding, goes hunting, and then must confront the very basic question of his true loyalties.

Vaun makes the Brotherhood look good, much better than poor, random, confused, corrupt humanity. It is thus appropriate that Duncan leaves open the question of who wins the battle, on Ult and among the stars.

Bruce Boston recently wrote to say thanks for reviewing his *After Magic*. "Most of the major SF reviewers seem to ignore the small/alternative presses entirely. Good to see that you don't." And "Here's my latest."

I'll get to that latest—**Hypertales and Metafictions**—in a moment. First, however, let me say once again that what I review depends very much on what lands in my mailbox. Getting something doesn't mean that I will necessarily review it—I get far too much material to make such a promise—but not getting it most definitely does mean that I won't review it. In addition, I figure most readers do not know that small press material even exists and are not likely to find it in their local bookstores. Small press material therefore needs much more review attention than "big press" material, and I am willing to help. Small press publishers and writers should take note.

Boston's latest is a small, reasonably priced pamphlet containing six stories—"Length, Breath & Plot," "Burning Man," "A Web for Demons," "Carmichal & the City," "All the Clocks Are Melting," and "Some Concrete Notions about Demons"—most of which have seen print in small press magazines such as *The Magazine of Speculative Poetry*. They have clear science fiction and fantasy elements, but they're *not* what you're used to seeing in this magazine. Yet you may still find them interestingly evocative, cryptic, arch, and

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even arty. Think of the British New Wave, and you're close.

If you plunge for the signed edition, you will also get **Other Voices—Other Worlds,** a cassette tape of Boston reading his own poetry, accompanied by synthesizer music by Monopoley. I was less impressed than by his prose.

The twelfth of Pulphouse Publishing's "Author's Choice Monthly" volumes is Spider Robinson's **True Minds.** However, as Spider himself warns you in his introduction, most of the book's contents were in his 1985 *Melancholy Elephants* collection. The new items are the introduction and the poems or someday song-lyrics that follow the five stories. The stories are "High Infidelity," a bit of erotica that doesn't strike me as strongly as it did the first time I saw it; "In the Olden Days," a poignant footnote to an age of waste; "Chronic Offender," a Runyonesque time travel jape; "Rubber Soul," in which his friends bring a certain idolized songsmith back from the dead; and the title story, which deals—perhaps a little too slickly—with the true meaning of love.

If you read *Scientific American* (and you should), you know A. K. Dewdney as the successor to Martin Gardner. Based at the University of Western Ontario, he has since 1984 been that magazine's "Computer Recreations" (now "Mathematical Recreations") columnist. He's also the author of *The Planiverse* and other books, but he's here now because of those columns: He has assembled them, with additional comments, into **The Magic Machine: A Handbook of Computer Sorcery.** Here you will find the Mandelbrot and Julia sets, with instructions on how to write computer programs that will bring them to life on your own computer screens. There are biomorphs, fractal popcorn, and Araphulian rope-and-pulley computers; nanomachines, mazes, primes, and a Martian dictionary; cryptography, core wars, and viruses. You can even find a description of my own poetry program.

Do I have to tell you how clever, enchanting, intriguing, and thought-provoking Dewdney can be? Then consider yourselves told, and go buy the book for yourselves and all your byte-bitten friends and relatives.

BOOKS ON DISK

The second issue of John Galuszka's on-disk (MS-DOS, 5.25 inch only) *Electronic Publishing Forum* is available for $3.00 shipping and handling from Serendipity Systems, P. O. Box 140, San Simeon, CA 93452 ($4 gets you the first issue as well). It contains an article on the hardware we will have to see to make on-disk books acceptable in a broad way. There is also considerable information on books already available—from many sources—in the electronic format; the SF authors you can get include Harlan Ellison and Robert Silverberg, among others.

Disk-topping is growing, folks, and you can't get the true dope much cheaper. ■

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brass tacks

Dear Dr. Schmidt:

I have just finished reading the two-part story, "Outlaw" by W.R. Thompson, which concluded in the October 1990 issue. I found the story interesting and thought provoking.

I was gratified to note that Thompson called the far distant settlement on the planet Pluto, Tombaugh Base. Whereas most people are aware that Pluto was discovered comparatively recently, and some know that this event took place at the Lowell Observatory at Flagstaff, Arizona, in 1930, very few people seem to know that the discoverer was a young astronomer named Clyde Tombaugh.

I am also pleased to be able to inform you that Dr. Tombaugh, now in his 80s, is still well and active. I am aware of this because one of our Phoenix newspapers published two interviews with him, one in 1988, and the second one in early 1990, to mark the 60th anniversary of the discovery of Pluto. It stated in one of these stories that Pluto is one of only two planets discovered by a single individual, the other being Uranus, discovered by William Herschel in 1781.

ELIZABETH ERICKSON

Phoenix, AZ

Dear Dr. Schmidt,

Your October 1990 issue was, as usual, an excellent read. The conclusion to W. R. Thompson's "Outlaw" was outstanding.

The one thing that bothered me was the cliche in Maya Kaathryn Bohnhoff's "Heroes." I have almost 20 years in the military, both active duty and National Guard and have appreciated the positive change in the public's attitude since the Vietnam Era, when I first put on the uniform. Bohnhoff's sop at the end of the story when she said, ". . . the counseling program hasn't

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been as much of a factor in the conversion process as we expected" was appreciated. But her use of the joint chiefs of staff as antagonists creating war to save their jobs is unrealistic. The most ardent "peaceniks" I know are military men. After all, they *know* whose flesh is going to be catching bullets and shrapnel long before the civilian's, whose liberty and rights they are protecting.

Other than the use of this hackneyed device the novella was an excellent story and I enjoyed the interplay and moral dilemma the scientific team presented.

JOHN H. FORBES
5387 Leprechaun Lane
Kearns, UT 84118

The author replies. . . .

Dear Stan,

I'm glad Mr. Forbes enjoyed the story despite his objections to what he thought were unrealistic clichés.

Like Mr. Forbes, I spent a significant portion of my life in the military—fifteen years, to be exact—as the daughter of a career Air Force sergeant. I spent a year and a half of that time waiting in uncertain anguish for letters from Qam Ran Bay in Viet Nam where my father was stationed during that conflict. Dad had no illusions about what was going on over there, nor about who was catching the shrapnel. It was *not* the gentlemen who were giving the orders; their posteriors were comfortably ensconced in padded office chairs at the Pentagon and SAC headquarters.

My father's experience in the military, most of which he spent at Strategic Air Command Headquarters near Bellevue, Nebraska, was that a discouragingly few officers really cared about the spiritual, emotional, and even physical well-being of the men under their command. Conversely, they cared a great deal about their personal aspirations and the prestige, authority, and luxuries afforded them by their rank. Unfortunately, precious few of them were "peace-niks."

Yes, I have some very strong reservations about the military. Notably, the way I have seen military training alter men's personalities and the way the military hierarchy creates a caste system that erects false barriers between human beings. But let me make it clear that I don't think that means we should scrap the military; I just think some aspects of it need to be rethought and adjusted or adapted to human reality.

In "Heroes," what I most wanted to avoid was painting stereotypes. I do not believe that all military men are ravening dogs of war who will go to untold lengths to ensure themselves a good spot in the next war, but I think history has abundantly proven that it only takes one man, surrounded by like-minded fellows, to create a situation that stuns the world to disbelief. Who could have foretold that a German student of architecture would build a military machine that would systematically exterminate millions of other human beings? Or that a wizened Muslim "divine" would unleash a wave of religious genocide in twentieth century Iran? Yet, these things happened.

I am aware that there are many fine, peace-loving individuals in the military who would rather be fighting famine than folks, but as our confrontation with Saddam Hussein illustrates, there are still those who can hardly wait to get to foreign shores and kick some foreign butt (if I may be so crass).

Attitudes *are* changing, but we will see the most significant changes only when we recognize (and by "we" I mean everyone on the planet) that there really is no such thing as a "foreigner."

MAYA KAATHRYN BOHNHOFF

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Dear Sir:

I have just finished "Heroes" by Maya Kaathryn Bohnhoff. A good yarn, but I am moved to write because of a mistake which the mastery of time travel in the story did not prevent.

The Serenity Prayer, made so well known by Alcoholics Anonymous, was not written by St. Francis of Assisi (died 1226), but by Reinhold Niebuhr (1892-1971), a Reformed theologian who taught at Union Theological Seminary in New York City. The story is that he included it in a sermon once while he was a guest preacher (somewhere in New England, I think). An auditor in the congregation asked for a copy of the prayer after the service, and Professor Niebuhr gave him the notes for the sermon, which he said he would have thrown away otherwise.

I almost feel like the science of Magda Oslovski's team at QuestLabs transported the Serenity Prayer from the late 20th century to the early 13th.

(FATHER) RAYMOND L. HOLLY

West Frankfort, IL

Dear Dr. Schmidt:

I am presently reading through a stack of *Analogs* which I allowed to accumulate over the past several months, and two stories in the October issue particularly attracted my attention.

"Heroes," the cover story by Maya Kaathryn Bohnhoff, is set in what President Bush would call a New World Order, which had its beginnings in a World Congress of 1992. Considering the world situation at this writing, I would not call that prediction unreasonable.

Ian Stewart's "Wall of Death," on the other hand, projects the Cold War (and indeed the continued existence of the German Democratic Republic) into 1997. Given the fast-forward nature of recent history and the long time that passes between a story's submission and its appearance in print, this prediction would also be reasonable, at least at the time it was written.

What I'm wondering is this: Did you rush Ms. Bohnhoff's story into print to be in step with the times, or does her crystal ball simply work better than most?

CARL STEIGER

Mercer Island, WA

We'll never tell!

Dear Dr. Schmidt:

I greatly enjoyed Ian Stewart's story "Wall of Death" in the October 1990 issue. However, I believe it contains a major flaw in engineering/physics logic that I am surprised passed your inspection. Assuming linear synchronous motors (or any other standard power I/O technology) are used to spin and despin the kinetic storage ring, the power rating is nearly the same for input and output. Since energy stored is proportional to the square of the velocity, starting from 800 kph, it would take 3 times as long to spin the ring up to 1600 kph as it would to bring it to a stop. Even if, for some contrived reason, different systems were used for input and output, loads for utilities are such that it makes no sense to have the power input rating significantly higher than the output rating of such energy storage devices.

JOHN R. HULL

Hinsdale, IL

P.S. There were some other minor design problems that I was willing to let pass for the sake of a good story. For example: 1. For utility load leveling, it makes no economic sense to store more than about 5 to 10 hours of energy. 2. The large containment forces dictate that a continuous ring be used. It is one thing to beat on the containment wall

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slowly, once a day, as the energy is used for diurnal load leveling. Beating on the wall every 18 seconds will lead to rapid fatigue failure or dramatic increases in cost. In addition, the "vehicle" is likely to be much cheaper than the tunnel. Therefore, it makes sense to fill up the tunnel with vehicle to reduce the cost of the energy stored.

Dear Dr. Schmidt:

In some 45 years of reading *ASF* and *Analog*, I cannot recall seeing in this magazine such a neatly packaged piece of propaganda as "Wall of Death" (October issue). It would not have been surprising to have seen it elsewhere, but how did it get through your editing process?

The trick started right at the beginning, with the "hero" collecting bottles of water near a nuclear power plant. There was no explanation for this skulking around looking for radioactive contamination, but it served to plant the thought that there must have been something to be found. If radioactive materials had been found in the water, a more likely source would have been a coal-fired plant in the area. But that kind of reality would have spoiled the story.

As the story progresses, we also have the miraculous energy storage device that depends on Japanese technology to make it work. The author apparently wants us to believe that by making successful high speed trains, the Japanese have also found out how to overcome the immense inertial forces that a hunk of metal weighing thousands of tons would exert when diverted into circular motion. I would prefer to go to a roller coaster manufacturer! In any event, a capability to perfect a storage device such as this without enormous power loss would seem to be roughly equivalent to that of perfecting fusion power. But this is supposed to be science fiction, so I really should not quibble about that.

What really bothers me is all the little statements salted throughout the story that are intended to prejudice the reader. On page 80 we have something called a "design capacity" that was missed by 30%, but that was supposed to be "close to perfection" by the standards of the nuclear industry. Perhaps this is just an indication of the ignorance of the author, since the term "capacity factor" is used to measure how any power plant performs and is not a reference to its nameplate power rating.

Then we have the plutonium that was stolen from an American civil reprocessing center. That would have been a pretty good trick, since Jimmy Carter shut down the only privately designed and built American reprocessing center that could have turned out plutonium. Why did the author have to invent an American center when Europe *does* have such operations?

OK, now that the hook has been set maybe the reader will accept a few more bits of propaganda. How about the denouement, where nuclear wastes are referred to as "the deadliest poisons known to man," the cost of nuclear power is stated to be "treble that of conventional sources," and we have that italicized reference to plutonium as having a half-life of 50,000 years. That "deadliest poison" bit is a lie invented some years ago by anti-nuclear activists. But it has been repeated so often that many people probably believe it now. I don't think anyone has yet taken up the offer by a professor to swallow a gram of plutonium if someone else will swallow a gram of nicotine.

The purported relative cost of nuclear versus "conventional" power sources

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seems to have come out of thin air, so I won't bother responding to it. Regarding half-lives, I have noted the uproar locally about an industrial plant that contaminated the surrounding land with chromium. And there are concerns nationally about lead, mercury, and many other contaminants. Have you ever thought about the fact that these elements *never* decay? There will still be just as much around in 50,000 years as there is now. But that sort of thought would have spoiled the story.

I'm sorry that this story is the cause for my first letter to *Analog*, for I have received much enjoyment over the years from reading it. There have been great stories as well as poor ones, interesting articles and boring ones, thought-provoking editorials and strange ones, good book reviews and trivial or prejudiced ones. The complimentary letters that I thought of writing never got written, but this rotten apple really bothered me. I can only hope that the publication of this story is an aberration that will not be repeated.

JOSEPH M. WEAVER

The author replies. . . .

Dear Mr. Weaver,

I wonder *whose* prejudice we're discussing here?

Why is the heroine collecting water near a nuclear plant? Jeez, does it *need* explanation? She belongs to an environmentally conscious group and she wants to check whether there's been a leak. (There *have* been leaks from nuclear installations, you know.) However, she doesn't find any contamination. You say her *failure* is a cunning piece of propaganda to suggest that really there *is* some contamination. Sure; and the general's conversion to the anti-nuclear cause proves that I'm *really* telling people that nuclear power is perfectly safe. If I say something's bad I'm prejudiced; if I say it's good, I'm *really* implying it's bad, and now I'm a hypocrite to boot.

I think you were reading things *into* my story, instead of just reading it. You clearly didn't read the title page: "The biggest danger in any technology may not lie in its machines, but in how people use them—and react to them." No; you just saw the word "nuclear," and after that you reacted with your hormones instead of with your brain.

I doubt that *Analog* has the space for me to deal with all your other points, but let's run a few of them by.

No, a coal-fired plant wouldn't have spoiled the story at all: in fact I could have written it that way. The general would have been converted to the cause of reducing global warming. Would that have made you happier? If so, why? It would be equally "propaganda"; just in a different direction. (For example, it's debatable whether nuclear power *would* reduce global warming: after twenty years or so it will have to move on to low-grade uranium ore, and that alters the equation.) I wonder what you think of the ending of *Lucifer's Hammer?* The heroes rescue a nuclear power station from destruction, to the benefit of the human race. To turn your argument on its head, why didn't Niven and Pournelle make it a *conventional* power station instead? It would have caused a few plot problems, but those could have been handled. The premise that makes the plot work is that when civilization is on the brink of destruction, *any* kind of power station is worth saving, environmentally friendly or not. *Lucifer's Hammer* isn't a pro-nuclear story at all, it just looks like one. Similarly, my premise is that the way people react to technology is often more dangerous than the technology itself, and

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that is what my story's really about.

Next, the "miraculous energy storage device," whose possibility you deride. We must be living in an age of miracles, then, because the device is entirely factual. Kinetic Storage Rings are a serious and technically feasible proposal, currently under investigation by the power generating industry. I admit I bent the figures for weight and speed a bit for dramatic effect, but not by much.

Not a single nuclear reactor among the forty or so in the UK has come within 25% of its intended generating capacity; some miss by 70% or more. In one of them, bolts corrode because some idiot saved a few pounds by making them with cheap steel instead of stainless, and every so often control rods drop into the reaction vessel, slowly shutting it down. In contrast, conventional power stations usually meet their design capacities.

A good many years ago the US was unable to account for several hundred kilograms of plutonium, and nothing I've seen since suggests that the situation has improved. People have broken into US Air bases in the UK, photographed themselves sitting on nuclear missiles, and departed without anyone at the base noticing a thing. So I think we can agree that terrorists, if sufficiently motivated and sufficiently lucky, might possibly get hold of enough plutonium to make a bomb. Yes, the plutonium could equally well have been stolen from Europe. Or Israel or India or France or Pakistan, or a dozen other countries. Would a different choice reduce the alleged propaganda content of my story? I chose a German power station, a Swedish treaty, and villains from all over the globe. So one lousy reference to the good ol' US of A being less than perfect makes me anti-American?

The relative cost of nuclear versus conventional power wasn't plucked from thin air. I got it from the British government. This not noticeably anti-nuclear institution recently increased its estimates of the cost of nuclear power by 200%. The figures supplied for the previous twenty years by the nuclear industry turned out to be, shall we say, highly optimistic. They ignored such costs as decommissioning and long-term storage of waste. The true figures became public when UK's electrical power stations were being floated on the stockmarket. The nuclear stations then had to be withdrawn because no industrial buyer would touch them. All this is a matter of public record.

Sure, chromium's nasty stuff. So's beryllium, as a lot of Russians are currently finding out. Even aluminum, if it gets into your tap water like it did a few years ago in the UK. Any environmental group will give you a very long list of dangerous pollutants. Plutonium's one of them . . .

Enough. Seems to me that what you're really saying is: I wrote a story that pushed some of your buttons and made you feel mad, so *Analog* shouldn't have published it.

Friend, that's unconstitutional.

IAN STEWART ■

●Nothing in the world annoys a person more than not being taken seriously.

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a calendar of analog upcoming events

7-9 June
CONTEXT '91/CANVENTION 11 (Canadian national SF convention) at Lister Hall, University of Alberta, Edmonton, Alta. Guests of Honour—*Spider & Jeanne Robinson*, Elisabeth Vonarburg, Frank Kelly Freas. Registration—C$30 until 1 June, C$35 at the door. Info: ConText '91, The WordWorks Building, 10523-100 Avenue, Edmonton AB T5J 0A8 CANADA.

27-30 June
MIDWESTCON 42 (the Relax-a-con) at Quality Hotel Central, Cincinnati, Ohio. Absolutely no programming. Registration —$18.50 until 1 June, $20 at the door. Info: Pat Sims, Midwestcon, 34 Creakwood Square, Glendale OH 45246. (Checks to Pat Sims).

4-7 July
WESTERCON 44/V-CON 19 (West coast SF conference) at Gage Residence, University of British Columbia, Vancouver, B.C. Guest of Honour—*William Gibson*, Artist Guest of Honour—Warren Oddison, Fan Guests of Honour—Jerry Kaufman and Suzanne Tompkins. Registration—C$45 (US$40) until 31 May; C$57 (US$50) at the door. Info: Westercon 44/V-Con 19, Box 48478, Bentall Centre, Vancouver BC V7X 1A2 CANADA.

5-7 July
INCONJUNCTION XI (Indianapolis area SF conference) at Adam's Mark Hotel, Indianapolis, Ind. Author Guest of Honor—Victor Milan, Artist Guest of Honor—Vincent Jones, TM—Arlan Andrews. Registration —$20. Info: InConJunction XI, Box 19776, Indianapolis IN 46219.

12-14 July
READERCON 4 (Massachusetts literary-oriented SF conference) at Worcester Marriott, Worcester, Mass. Guest of Honor—Thomas M. Disch. Registration—$22 until 31 May. Info: Readercon, Box 6138, Boston, MA 02209. (617)576-0415.

19-21 July
LIBERTYCON 5 (Chattanooga-area SF conference) at Sheraton City Center Hotel, Chattanooga, Tenn. Literary Guest of Honor —James P. Hogan, Artist Guest of Honor— David Cherry, Special Guest— Sharon Green, MC—Wilson "Bob" Tucker. Registration —$25 until 1 July, $35 thereafter and at the door. People under 18 must be accompanied by a parent or legal guardian. Info: Libertycon 5, Box 695, Nixson TN 37343.

19-21 July
GAYLAXICON '91 (SF/Fantasy convention for gay people and their friends) at Tewksborough, Mass. Guest of Honor—Samuel R. Delany; Artist Guest of Honor—Hannah M. G. Shapero. Registration: $20 until 30 June, $25 thereafter. Minors must be accompanied by parent or guardian. Info: Gaylaxicon '91, Box 1052, Lowell MA 01853. Note: unlike previous Gaylaxicons, this one is fully programmed.

29 August-2 September
CHICON V (49th World Science Fiction Convention) at Hyatt Regency, Chicago, Ill. Guest of Honor—Hal Clement; Artist Guest of Honor—Richard Powers; Editor Guest of Honor—Martin H. Greenberg; Fan Guests of Honor—Jon & Joni Stopa. Registration —$150 at the door. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition—the works. Join now and get to nominate and vote for the Hugo Awards and the John W. Campbell Award for Best New Writer. Info: Chicon V, Box 218121, Upper Arlington, OH 43221-8121.

8-14 September
VOLGA-CON (International SF convention on the Volga). Sponsored by SF Club "The Winds of Time" and the Youth Association ATOM. Info: Volga-con, % Boris A. Zavgorodny, Volgograd-66, Poste restante, 400066 U.S.S.R. Telephones: 34-74-62, 34-74-64, 34-44-09, 34-86-56.

—Anthony Lewis

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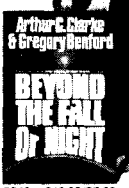

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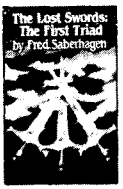

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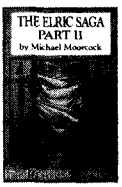

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